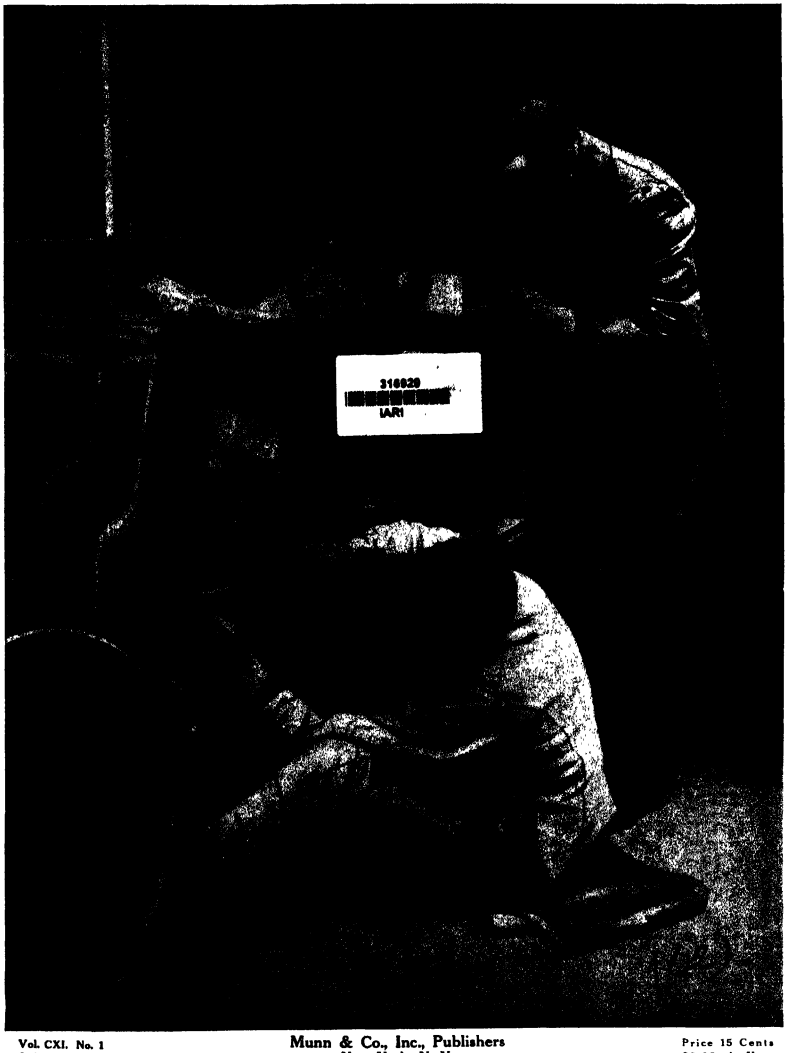


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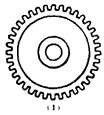
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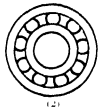
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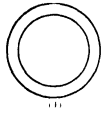
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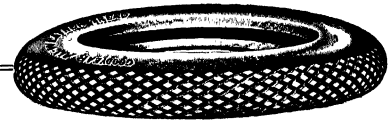
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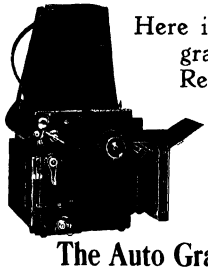
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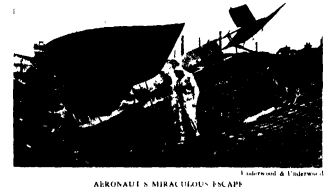
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SEVENTIETH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXI] NEW YORK, JULY 4, 1914 [15 CENTS A COPY $3.00 A YEAR

NUMBER 1.]

"Shamrock IV" in Drydock

Her Form Shows That the Challenger Will be Formidable in Fresh to Strong Breezes.

IN spite of her lofty sail-plan, "Shamrock IV," in her trials against the 23-meter "Shamrock," proved to be too stiff for the best results. She was placed in drydock and five tons were removed from her lead bulb. It was during this docking that the accompanying photographs were taken; and they are the first views that give a correct impression of the challenging yacht's under-water profile and model.

It takes but a glance at these two views to see that designer Nicholson has aimed at securing the most powerful boat that was possible under the limitation of a 75-foot water-line length. In doing this, he evidently was satisfied that the penalty imposed by the rule on full ends would be more than offset by the premium gained through large displacement (which the rule encourages), and by the great sail-carrying power which goes with the shoal, full-ended, bulb-fin type of hull.

Of the three cup defenders, "Resolute" is farthest removed in model from "Shamrock IV," and a study of the accompanying line-drawing, showing the approximate midship sections and water-line planes of the two yachts, will be of interest.

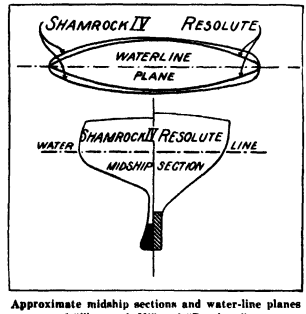
"Resolute" is built closely to the rule. She has very fine ends, conforming to the "quarter-beam" requirement. She has a deep V-section, with an easy bilge and steep floor, insuring a combination of large displacement with a form easy to drive. The rule favors sharp-ended boats of moderate beam; encourages displacement, and penalizes sail area. "Resolute" is a sharp-ended, moderate-beam boat, of large displacement and moderate sail area. Hence, her rating is low, and it is certain that "Shamrock IV" will have to allow her, should she be the chosen defender, a large time allowance, not less, surely, than five or six minutes.

The new rating rule, however, takes no direct account of an element in yacht design, which, in races sailed in September over the Sandy Hook course, is one of the most important of all. We refer to the "wetted surface." In this respect "Resolute" has considerable advantage over both "Vanitie" and "Defiance," and will have an enormous advantage over "Shamrock IV."

In a recent editorial we drew attention to the fact that, in light winds, when the speed of two competing yachts of the 75-foot class is, say, 6 or 7 knots, the skin friction is the most important resistance, and the yacht with the larger ratio of sail area to wetted surface will be the faster, other things being equal.

It is largely this feature in "Resolute" which causes her to pull away from her rivals as the wind lightens and the speed decreases.

Now, if the midship section of "Shamrock IV" is compared with that of "Resolute," it will be seen that a tapeline measurement, touching the hull, around "Shamrock IV" will give her several feet more girth than "Resolute." Similarly, a linear measurement around a horizontal section of the two yachts at the water-line will show that "Shamrock IV" has the greater perimeter. Hence, the wetted surface of "Shamrock IV" must greatly exceed that of "Resolute." This raises the question as to whether the excess of sail carried by the challenger will suffice to overcome this difference, plus the time allowance. In the last series of races for the cup, "Reliance" had more wetted surface than "Shamrock III"; but she had over 16,000 square feet of sail as against "Shamrock's" 14,000, and in light winds she easily drew away from her.



Approximate midship sections and water-line planes of "Shamrock IV" and "Resolute."

The broad, shoal body of "Shamrock IV," giving a high center of buoyancy, and her heavily bulbed lead, giving a low center of gravity, account for her great sail-carrying capacity, and in strong winds sufficient to put her down to her lee rail, she should be a very fast boat. Moreover, her unusually long fin keel (30 feet on the bottom, or 50 per cent more than the keel of "Resolute"), although it still further increases her wetted surface, should make her point high into the wind when close-hauled. She should be the fastest boat of the four in winds of from 12 to 25 knots, particularly when the wind is offshore and the sea is smooth. Under these conditions she should also be fast in reaching.

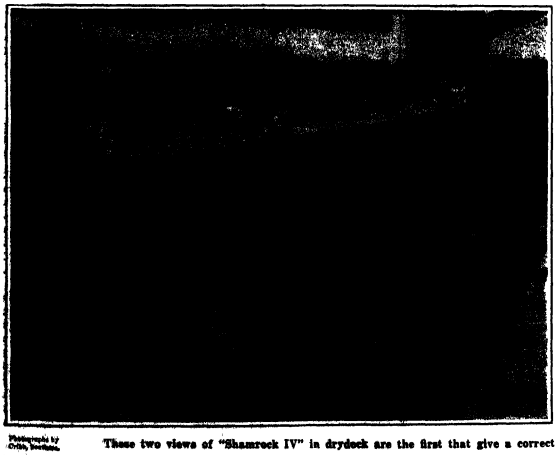
But how often do such winds prevail in September on the Sandy Hook course? They are extremely rare. The writer, during one of the "Shamrock" series of races, went out eleven times to Sandy Hook without seeing two races completed within the time limit, so light were the winds.

"Shamrock IV" has more than once beaten the 23-meter "Shamrock" a minute a mile in fresh breezes, but as the wind lightens, the older boat seems, so far, to hang on to her rather closely. The removal of lead, enabling the boat to heel down to her best sailing lines, appears to have made her more lively in light winds, and she will improve as the tuning up progresses.

In any case, there is promise of a very interesting contest next September.

A Water Model of the Electric Arc

ONE of the essential properties of the electric arc is that, when the current through the arc increases, the potential difference between its terminals decreases. At the recent Conversazione of the Royal Society, Mr. W. Duddell exhibited a water model of the electric arc which consists of a mushroom valve. The pressure tending to reseat the valve is so arranged that it diminishes very rapidly as the valve lifts. In this way, when the flow of water is increased through the valve, the difference of pressure between its two sides decreases and thus represents one of the properties of the electric arc. When a steady flow is established and a column of water having a definite periodic time is connected to the valve, oscillations can be set up similar to those obtained with an electric arc.





Photographs by Orbis, Boston.

These two views of "Shamrock IV" in drydock are the first that give a correct impression of her under-water profile and model.

Evidently the designer has figured that the penalty imposed, by the rule, on full ends would be more than offset by the premium gained through large displacement, and by the great sail-carrying power which goes with the shoal, full-ended, bulb fin type of hull.

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short* and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Mr. Brewer Criticises Langley

In a letter which recently appeared in the New York *Times*, Mr. Griffith Brewer, well known in British aeronautical circles, ungeneously criticises the work performed by the late Samuel Pierpont Langley, and thus tends to throw additional discredit upon a man who in his lifetime suffered much abuse but who as a pioneer in aerodynamic experiment laid for his successors a secure foundation of principle on which they might safely build.

Most great inventions are not absolutely original productions. They are what in the parlance of the patent lawyer, are called new combinations of old elements, *producing new results*." Because they do produce new results they may be of epoch making importance, and entitled to the protection of the patent laws. Every one of the great technical achievements of the past, thus considered, is curiously old and yet strikingly new, the brilliant and enduring work of the Wright brothers not excepted.

When it comes to sheer inventiveness, Langley outdistanced every experimenter in aviation with the one exception of Hiram Maxim. From Newton to Newcomb mathematicians had proved, apparently with all the conclusiveness that mathematics gives, the utter absurdity of attempting to fly mechanically. A surface increases as the square, a weight increases as the volume or cube, obviously a very small increase in weight or volume meant a hopelessly large increase in carrying surface. That reasoning was successfully used to shatter the hopes of those who believed in the possibility of mimicking the soaring bird.

Into this field, occupied by monomaniacs, who were classed with circle squarers, perpetual motion believers, and similar scientific madcaps, Langley ventured, determined to bring scientific reasoning and experiment to bear where there had been only wild raving. His first work was to establish beyond a doubt that the mathematicians were wrong in maintaining that a proibitively large surface would be required to carry a small weight. To upset the scientific axioms of centuries by brilliantly novel experiments was in itself an achievement. But he did much more. Not only did he demonstrate conclusively exactly what were the character and magnitude of the forces acting upon plane surfaces in motion, but he eventually succeeded in building the first successful motor-driven model of a flying machine in the history of the world. Never before had there been such a contrivance, never with the single exception of Penaud's rubber-motor models, had a mechanical contrivance sustained itself in the air for so much as a minute. And yet Mr. Brewer fails to understand why so much attention is given by the newspapers to this man!

It is quite beside the mark to compare the general efficiency of the Wright machine with that of the Langley "Aerodrome." The sole purpose of the Hammondsport test is to continue an experiment begun by Langley, but unfortunately terminated because of adverse newspaper criticism. In justice to Langley's memory, it is fitting that the machine should be thoroughly tried. Mr. Curtiss has nothing to gain by the experiment. Wing warping is not involved. The success of the Langley machine, decided enough from the standpoint of the patent lawyer, will not help Mr. Curtiss in the least. His is an act of piety, which deserves commendation.

No one realized more keenly than Langley himself the limitations of his aerodrome. We open the "Langley Memoir of Mechanical Flight" published by the Smithsonian Institution and we read this: "It was thought that a control mechanism which should be more sensitive and at the same time should act more powerfully [than the Penaud tail] to prevent the upsetting of the equilibrium when the machine was subjected to rather strong disturbing forces, was desirable for any machine which was to transport a human being, and therefore involved the risk of a fatal accident." Over and over again it is expressly stated that Langley regarded this machine only as an experiment. It was a step from an unmanned to a manned machine. Had the great secretary of the Smithsonian Institution been spared to continue his work, he would unquestionably have employed other controlling mechanism than the dihedral angle and the automatic tail, although machines on the Langley principle, notably the "Fokker," have flown successfully in Europe over and over again.

The problem of control constantly haunted Langley. Better than any of his predecessors, he realized how all-important it was. There was hardly a form of control which he did not at least sketch out on paper. "The more frequently recurring of these," says the Langley memoir, "were devices for *changing the angle of the wings to fall*, and others for shifting the wings or tails bodily, so as to shift the position of the center of pressure with respect to the center of gravity, the motive power for operating the devices being in some cases derived from a gyroscope or pendulum, and in others small electric motor apparatus controlled by a pendulum or a gyroscope." Evidently Langley had thought out for himself practically every system of control which has been tried since flying became a reality.

In singular contrast to Mr. Brewer, the Wright brothers have always generously acknowledged their indebtedness to Langley and Chanute. They at least knew how necessary was the work of these two great pioneers before the marvelous Wright flier could soar.

Battleships as Peacemakers

THE decision of Congress to sell the two predreadnoughts "Idaho" and "Mississippi" to Greece was influenced to no little extent, it is rumored, by the desire of President Wilson to avert war between Greece and Turkey. That the sudden increase in the naval strength of Greece by the acquisition of these two ships has served to prevent a seriously threatened renewal of the Balkan hostilities, is believed by those who are familiar with the naval and diplomatic conditions so far as they affect Turkey and Greece. Certainly the naval situation, as recited below, justifies this conclusion.

During the Balkan war the Greek navy showed a decided superiority over that of Turkey, but the situation was completely reversed, at least as far as regards *material*, when Turkey recently purchased the powerful dreadnought which is nearing completion at the yard of the Vickers firm in England. This ship, the "Rio de Janeiro," which was illustrated in the SCIENTIFIC AMERICAN of May 31st, 1913, is one of the largest and most powerful dreadnoughts yet constructed. With a length of due feet, a displacement of 27,500 tons, and a speed of 22 knots, she mounts the largest 12-inch battery in the world, carrying, as she does, no less than fourteen 12-inch, 50-caliber guns in seven 2-gun turrets. In addition to this she has a secondary battery of twenty 6-inch, 50-caliber guns. Her main battery, be it observed, is more powerful by two guns than that of our "Arkansas" and "Wyoming."

Now the purchase by Turkey of this powerful ship had completely altered the relative standing of the two navies, for with her overwhelming gun-power and good speed of 22 knots, she would have been capable of handling unaided the whole Greek fighting line. Hence it can be understood that, in the recent trouble with regard to certain islands that have been ceded to Greece, Turkey felt herself to be in a position to enter into a controversy, which, should diplomacy fail, would be settled in her favor upon the high seas.

Greece, in her dilemma, looked around for some ready means of turning the tables upon Turkey and backing up her diplomacy by a show of superior naval strength. It so happened that the "Rio de Janeiro" was not quite completed and would not be available for use by Turkey for some little time; and when, as the result of her search in the battleship market of the world, Greece found that two thoroughly equipped and well-seasoned battleships of the United States Navy were available for sale, the negotiations were opened which have resulted in the purchase of the "Idaho" and the "Mississippi."

To those of us who understand the intimate relations between battleship strength and a nation's foreign policy, it is not surprising that this sudden reversal of conditions should have had the immediate effect of dissipating the war cloud and leading these two nations to arrange a peaceful compromise.

And so, once more, we see a concrete illustration of the truth that a preponderance of naval strength sufficient to secure the command of the sea, serves not as a provocative to war, but as a means, and a most effective means, of preserving the peace. Greece, exhausted by the recent struggle, had no desire to renew it; Turkey, eager to recover some of the prestige she has lately lost, and believing herself to possess a preponderance of sea-power, would, no doubt have welcomed the conflict.

Battleships are cheaper than battles; and, as we have shown in our recent series of articles on the problem of our own Navy, there is no surer way to preserve the peace than to maintain an adequate naval force, sufficient to discourage any foreign country from attempting to interfere with national policies by a demonstration of naval force.

As regards the relative advantages of this bargain, they are fairly well balanced between the two countries. For Greece, the acquisition of the "Idaho" and "Mississippi" means not only a great increase of strength, but the prevention of a war which would have cost far more than the price paid for the ships. As regards the United States it means the substitution for two predreadnought ships of a modern dreadnought of the largest size and of maximum offensive and defensive power. How great is our gain is shown by the following consideration:

For the sum derived from the sale of the "Idaho" and the "Mississippi," whose aggregate displacement is 26,000 tons, we can build a 32,000-ton "Pennsylvania," which is a clear gain of 6,000 tons of displacement.

For the eight 12-inch guns of the two vessels, we secure twelve 14-inch guns—a clear gain of four 14-inch pieces.

The total muzzle energy of the eight 12-inch guns is 350,000 foot-tons. The total muzzle energy of the twelve 14-inch guns is 780,000 foot-tons—a clear gain of 420,000 foot-tons, which is an increase in hitting power of considerably over 100 per cent.

In place of the 9-inch armor on the "Idaho" and "Mississippi," covering the waterline, we have the 13½-inch armor on the "Pennsylvania"—a gain of 4½ inches in thickness, and a gain, furthermore, in the quality of the armor, due to later methods of treatment.

For the speed of 17 knots of the "Idaho" and "Mississippi" we have a speed of 21 knots in the "Pennsylvania"—a clear gain of 4 knots.

Finally, and most important of all, is the fact that in place of two of the smaller ships of our second line of battle we are able to put into our first line of battle one of the most powerful and up-to-date ships of the dreadnought class.

Some Great Marine Disasters

A RECORD of the most serious marine disasters since 1850 shows that the list is headed by the sinking of the "Titanic," when 1,595 people were lost. This is followed by the recent loss of the "Empress of Ireland," the total of whose fatalities is now placed at over 1,024. It is estimated that 1,000 lives were lost in the burning of the "General Slocum" in the East River, New York, in 1904. In September, 1912, the "Kickermaru" was wrecked off the coast of Japan, with a loss estimated at 1,000. In September, 1905, the Japanese warship "Mikasa" sank with a loss of 599. In June, 1894, the "Norge," wrecked in the North Atlantic, went down with a loss of 600. In September, 1890, a Turkish frigate foundered off Japan with a loss of 540. In August, 1876, the "Great Queensland," loaded with powder, is supposed to have been blown up in mid-ocean, for she was never heard of again, and 589 perished. In April, 1873, the "Atlantic" of the White Star Line was wrecked off Halifax with a loss of 547.

The Rigidity of the Earth

THAT the earth is not an absolutely unyielding solid has long been known, and there are several methods for evaluating the elasticity of the whole earth. The results are a little surprising. The ocean tides have an amplitude less than that they would have if the earth were absolutely rigid, and from this difference the rigidity of the earth may be calculated. On this method it appears that the earth is about as rigid as if it were composed wholly of steel.

A second method is based on observations made on the displacements of the poles. If the earth were absolutely rigid this movement would have a period of 305 days. The actual period is longer, and the difference enables the elasticity of the earth to be calculated.

Rabbits on Laysan Island, the well-known Hawaiian bird reservation, have multiplied to such an extent since they were introduced a few years ago as to threaten the existence of the island vegetation. As this result would jeopardize the bird colonies, which need shade, especially during the nesting season, an expedition which recently visited the island destroyed about 5,000 rabbits, or one half the total colony.

[illegible] recent issue from [illegible] an account of the blast[illegible] feet in length which contains [illegible] work done with 1,400 pounds [illegible] dynamite. The total cost [illegible] per cubic yard.

[illegible] Canal.—Under one of the new [illegible] recently promulgated by Col. Goethals, a vessel [illegible] Gatun Lake from either end of the canal, and, without [illegible] through the locks at the other end, may return to the original point of entry of the canal, without payment of additional toll.

Economy of Electric Welding.—Before the Ohio Society of Mechanical, Electrical and Steam Engineers, it was recently stated that in a locomotive shop using electrical welding apparatus the cost of repairing forty cracks in side sheets of fire boxes by electric welding was $6.65. To renew the damaged sheets would have cost about $1,320.

Vitality of Wooden Bridges.—Bridges built of timber, and particularly those of the Howe truss type, have shown a remarkable longevity, especially where they are covered in from the weather. A case in point is a bridge over Little River, near Springfield, Mass., which was recently torn down. It was built in 1835 and was only recently removed for reconstruction because of decay in some of the woodwork.

The World's Largest Ship.—The third of the famous trio of large ships which the Hamburg-American Line will have in service next year was recently launched at Hamburg. She was christened the "Bismarck" by the German Emperor before a notable gathering. The new liner is 955 feet in length, 100 feet in beam, and of 60,000 tons displacement. Like the "Vaterland," she will be driven by turbines operating on four shafts. She is designed to maintain an average speed of about 23.5 knots.

The Opening of the Berlin-Stettin Canal.—The opening of the Berlin-Stettin Canal in the presence of the Kaiser marked the inauguration of the active service of a new waterway, which, it is expected, will ultimately raise Germany's most important seaport in the Baltic to a position of importance rivaling that of the North Sea harbors of Hamburg and Bremen. The canal cost $12,500,000, and it is estimated that every year about three million tons of freight will be shipped through the new waterway.

Air Propeller Boat for Demerara.—The *Engineer* of London describes a boat propelled by an air propeller which has been constructed for use in Demerara. The vessel is 30 feet in length and 10 feet in beam, and is of the barge type. It is driven by a 15-horse-power oil engine, chain connected to a 9-foot air propeller, which runs at 1,200 revolutions per minute. With a thrust of 200 pounds it is stated that the tow barge has made an average speed of 5 miles per hour. The design is certainly more curious than economical.

Old Battleship as Target.—The results obtained from the old battleship "Texas," when she was used in 1910 as a target, have been so valuable as a guide to the design of battleships, that the request of naval officers that our obsolete battleships, such as the "Iowa" and "Indiana," be used for such target practice, should receive every encouragement. England, France and Germany have been making a free use of obsolete ships for this purpose, and the information thus acquired is of far more value than the cash sum which could be realised in selling these vessels to be broken up.

A Concrete Buoy.—Reinforced concrete, during the past few years, has been invading many fields which hitherto have been considered as belonging exclusively to iron and steel. One of the interesting illustrations of this fact is the construction of a concrete buoy at Kingston, Jamaica. It is stated that the cost is only about fifty per cent of the cost of a similar buoy made of steel. To prevent the mooring chain from injuring the bottom of the buoy, the latter is made concave. The manhole cover was grouted into its place after the buoy was afloat. Leakage is handled by means of a small pump-hole provided for that purpose.

Water in Exchange for Refuse.—Milwaukee has a refuse incinerator with a total capacity of 300 tons a day. A 600-kilowatt-hour turbo-generator is driven by the steam raised in a 300-horse-power boiler. The current from the generator is to be transmitted to a flushing-tunnel pumping station, some two miles distant, for pumping lake water into the north end of the Milwaukee River for flushing and cleaning purposes.

Locomotive Gases as Conductors.—It is well known that disturbances may occur from high pressure trolley wires by steam locomotives through the exhaust stack. These may take place through greater distances than [illegible] are so short, and [illegible] escaping from the [illegible] a locomotive was exhausting [illegible] and [illegible] locomotive [illegible] is explained on an average about [illegible] when the loco[illegible]

Science

The Journal of Egyptian Archæology.—A new quarterly journal with this title has been inaugurated by the Egyptian Exploration Fund, in London. It will deal with all branches of Egyptological research.

Population of the Balkan States.—The following are the latest estimates of population in the reconstructed Balkan States, according to the *Geographical Journal*: Turkey in Europe, 1,560,000; Bulgaria, 4,467,006; Rumania, 7,514,976; Servia, 4,547,990; Greece, 4,363,000; Montenegro, 516,000; Albania, 1,000,000.

Memorial Chair to John Henry Poynting.—Through the generosity of Sir George Kenrick, the Chair of Physics at Birmingham University has been endowed with securities to the value of $90,000, in memory of the late John Henry Poynting. The Mason Chair of Physics will accordingly henceforth be known as the Poynting Chair of Physics.

Sir Douglas Mawson.—The honor of knighthood has been conferred upon Dr. Douglas Mawson, leader of the recent Australasian Antarctic Expedition to Wilkes Land. Mawson was also a member of Shackleton's Antarctic expedition, and has made geological explorations in the New Hebrides. He was born in England but educated in Australia, where he has spent most of his life.

A New Town in Central Asia.—The Russian Ministry of Agriculture is planning to construct a new town, to be called Amu-Darjinsk, in the Hunger Steppe of Central Asia, which has now been made available for agriculture by the irrigation system of the Romanov Canal Parcels of land are to be leased, and will ultimately become the property of the tenants. More than 4,000 applications for land have already been received.

A Fur-Seal Commission, consisting of Mr. Edward A. Preble, zoologist biologist of the U. S. Biological Survey; Mr. W. H. Osgood, of the Field Museum of Natural History, Chicago, and Dr. G. H. Parker, of Harvard University, has been sent by the Government to the Pribilof Islands this summer to ascertain the condition of the seal herd, and to study various economic and scientific questions connected with its administration.

The Transcontinental Geographical Excursion in 1912.—An echo of this memorable enterprise, which was conducted by the American Geographical Society for the purpose of giving foreign geographers an intimate view of the United States, is the announcement just made by the society that a memorial volume will be published this summer, containing 26 papers written by participants in the excursion. The papers will be technical in character, and written in several languages.

Radioactivity at the Panama Exposition.—A committee has been formed in Germany to arrange an exhibit at the Panama-Pacific Exposition, 1915, which will cover the whole field of radioactivity and illustrate in a striking manner the vast development of the subject since the historic discovery made by the Curies in 1898. The exhibit will trace the history of discoveries in radioactivity and allied branches of science; show methods of producing radioactive substances: and illustrate all known phenomena and applications of radioactivity in physics, chemistry, medicine, and various industries. Numerous technical and popular lectures, accompanied by experiments, will be given in connection with the exhibit.

International Upper-Air Research in the Arctic.—The Rome (1913) meeting of the International Meteorological Committee appointed a special commission, with Gen. Rykachev, of St. Petersburg, as president, to arrange an international campaign of upper-air observations around the north polar basin in conjunction with similar observations to be made by the forthcoming Arctic expeditions, especially Amundsen's proposed north polar drift The commission held a meeting at Copenhagen, February 28th to March 1st of the present year. It was announced that the Canadian government had decided to equip at least two and perhaps four Arctic stations with balloons and theodolites, and that upper-air observations would be made by one or both sections of the Canadian Arctic expedition now in the field. Two Canadian stations, one at York Factory and one at the northern point of Labrador, are to be equipped with wireless telegraphy. The Russian meteorological service hopes to establish stations at a point in Nova Zembla, at Yakutsk, and at Verkhoyansk, equipped with kites, pilot-balloons, and sounding-balloons; while pilot-balloon stations will be operated at Alexandrovsk, Archangel, Vaigach Island, and Obdorsk. The Danish government will have stations in operation at Disco Island, West Greenland, and in Iceland. The German observatory in Spitzbergen will co-operate, and several other stations are proposed. It was decided that, as far as possible, daily observations should be made at the stations, especially during the period from September, 1915, to September, 1916, when it was expected that Amundsen would be nearest the pole. Since the meeting of the commission, Amundsen has announced the postponement of his expedition for another year, and the arrangements described above will doubtless be modified accordingly.

Astronomy

The Problem of Minor Planets.—In a paper before the Académie des Sciences, Louis Fabry indicates two approximate solutions for the calculation of the orbits of the minor planets; one consists in neglecting the perturbations of the elliptic movement and to take four observations neither too close nor too far apart, taken for example in two successive oppositions; the other consists in calculating the orbit by means of four observations taken in four different oppositions, but taking account of the perturbations due to Jupiter The formulæ established by these methods give a sufficiently approximate solution of the problem of the minor planets.

The Unknown Gases of the Nebula in Orion.—By studying the light emitted by a luminous gas, it is possible, by purely optical methods, to determine the temperature of the gas and also its atomic weight. Observations on the nebula in Orion have been pursued since 1911. By studying the lines in the spectrum of the nebula which are due to hydrogen, it appears that the temperature of the hydrogen in the nebula is about 15,000 degrees The double ultra-violet line, which is attributed to the hypothetical gas called "nebulium," gives as the atomic weight of this unknown gas the figure 3. A strong green ray, which is also due to an unknown gas, gives the figure 2 for its atomic weight

The Nebula in Andromeda.—It is now an established fact that the majority of the nebulæ known to us are spiral nebulæ Their study is very important, and in particular a knowledge of their spectra is capable of furnishing us with valuable information. The study of the spectra of nebulæ is rendered very difficult by the small *intrinsic brightness* they possess. Nevertheless, some careful experiments made by Slipher on the nebula in Andromeda render it probable that the nebula has a radial velocity of about 300 kilometers per second, a result which is distinctly greater than the figures formerly obtained for other nebulæ. If the nebula in Andromeda approaches the solar system with this velocity, it suggests that the new star which appeared near its nucleus in 1885 had been a dark star which was encountered.

Displacements of Groups in Space.—During the last year researches have been made in the observatory at Potsdam on the radial velocities of the principal stars in the group Praesepe and the results obtained are very interesting The group appears to be characterized by a large positive radial velocity, the average velocity being about 36 kilometers per second. But the movements of this group seem strongly analogous to the movements of the group Hyades Schwarzschild and Hertzsprung have accordingly investigated the hypothesis which supposes that the two groups are animated by movements identical in magnitude and direction, and it would seem that this hypothesis is confirmed by the results. But the data so far obtained are not sufficient to enable one to decide whether this analogy of movement implies a physical correspondence in the spectra of the stars forming the two groups.

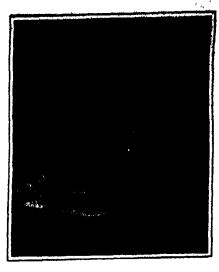
Proper Movement of Feeble Stars.—It is usually considered that the proper movements of the feebler stars cannot, in the majority of cases, be determined, a conclusion based on the assumption that, on the average, the distances of the feebler stars are greatly superior to those of the brilliant stars. Hence the latest results of Comstock, the conclusions from which appear to invalidate this conclusion, are of the highest interest. Comstock has examined 515 stars of magnitudes varying from 7 to 13, and he has found that of this number there are 390, i. e., about 75 per cent, which possess an appreciable proper motion. Considerations drawn from the distribution of the bright stars are confirmed on examining the distribution of the feebler stars. Since the linear value of the stellar movements seems independent of the magnitude, Comstock deduces that, feeble or brilliant, the stars constitute parts of the same stellar system, and that the feeble stars are in reality less distant than would appear from photometric considerations.

Relations Between the Color, Spectra and Parallax of Stars.—Nasshan, in the *Astronomische Nachrichten*, has published a very interesting investigation on the above subject. In seeking the relation between color and parallax he has considered 101 stars for which the color is known and the parallax determined. With respect to color the stars have been classed in three categories: (1) white stars, (2) yellow stars, and (3) red stars. Then three groups have been formed of stars of which the parallax is comprised between the limits 0.00 sec to 0.05 sec.; 0.05 sec. to 0.10 sec.; 0.10 sec to 0.20 sec., and, for each class of colors, the percentage of stars belonging to each parallax group has been determined. It is found that the proportion of white stars diminishes as the parallax augments, and inversely, in the case of the red stars. With respect to the spectra, 240 stars were examined and the distribution of parallaxes among the various types of spectra determined. The spectral classes *A* and *B*, to which the white stars belong, were found to contain only feeble parallaxes, the spectral classes to which the red stars belong containing stronger parallaxes, so that the two methods give concordant results.



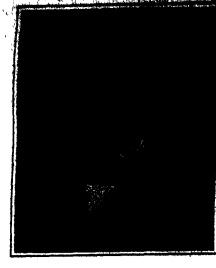
Prof. E. Bumm of Berlin.

A strong supporter of the use of radium and X rays in treating myoma and allied diseases



Friedrich Dessauer of Frankfort.

Who has done pioneer work in establishing the physical principles of radiotherapy.



Prof. B. Krönig of Freiburg.

Who is very optimistic regarding the future possibilities of the X-ray treatment of tumors.



Prof. de la Camp of Freiburg.

Who has been conducting experiments on the use of X-rays in the treatment of tuberculosis.

X-Rays in the Treatment of Disease

The Rationale of Their Application

THE curative power of radium and X-rays has formed the subject of many a more or less sensational notice in the daily and popular press. But the public knows very little as to the details of the actual methods employed and the principles upon which they are based

Among the men who have worked out the scientific principle of the X-ray treatment of tumors and other affections, perhaps none has made more valuable contributions than Friedrich Dessauer, director of a large works at Mannheim, where X-ray tubes and all their appurtenances, as well as many other refined electrical apparatus, are made. It required the labors of a physicist, working hand in hand with many medical men, among them some of the foremost of the profession in Germany, to establish the principles—mainly physical—on which the rationale of the most effective treatment should be based. Friedrich Dessauer is the man to whom the systematic development of this field is chiefly due. We shall here briefly indicate the essence of the principles laid down by Dessauer

The problems which have to be solved in extending the usefulness of radiation methods for the treatment of disease are only in part biological. The very foundation of radio-therapy rests upon physical science. The debt of medicine to Röntgen is not likely to be forgotten. But other physicists, who have done much faithful work in developing the modern technique of radiotherapy, have not always received that appreciation which they so justly deserve. Among them particular credit is due to Friedrich Dessauer, director of a large electrotechnic establishment at Frankfurt on the Main. The story of Friedrich Dessauer's life work in this field is of peculiar human interest. It was at the time when Röntgen's discovery had just aroused public attention, that Dessauer, then a student in Munich, was asked by the physicians attending on his sick brother, to make an X-ray diagnosis of his ailment. The verdict, which was only too conclusive, was later confirmed by the fatal issue of the disease, sarcoma. These events made a profound impression upon Friedrich Dessauer, who resolved to devote himself henceforth to the furtherance of medical applications of X-rays.

At that time this was a much more difficult task than to-day. The technique of the construction of X-ray apparatus with all their appurtenances was as yet undeveloped. Moreover, no institute existed then, in the whole of Germany, offering facilities for the physicist to conduct research in the application of his science to medicine.

Another man might have thought this an unsurmountable obstacle. Not so Dessauer. If no such institute existed, he must found one. He, therefore, established a small factory for the manufacture of electrical apparatus, and from the proceeds he financed his experiments in his chosen field. From this nucleus has grown the large establishment of which Dessauer is to-day the director.

Difference in Sensibility of Tissues.

A basic fact, without which radiotherapy would be impossible, is that different tissues react differently toward the same radiation. Moreover, this variation in sensibility is not haphazard, but follows a simple law: If the different tissues are tabulated in order of their "juvenility," it is found that those at the "juvenile" end are most susceptible, those at the "adult" end least susceptible to X-rays. The words "juvenile" and "adult" as here applied to types of tissue require explanation. Certain cells have marked power of proliferation, and undergo rapid cell division. Immature, growing tissue is of this type, as is also, unfortunately, the tissue of morbid growths, tumors, cancers, etc. These are what have been termed above "juvenile" cells. In technical language they are spoken of as cytotypic. On the other hand, the cells of a fully formed organ often remain unchanged for years. These, the organotypic cells, are there referred to above as the "adult" type.

The importance of this in the treatment of morbid growths needs no emphasis. Were it not for this difference in reaction, it would be difficult or impossible to treat diseased tissues without at the same time subjecting the sound tissues to the same destructive influence.

The Several Components of X-rays, and Their Different Action upon Tissues.

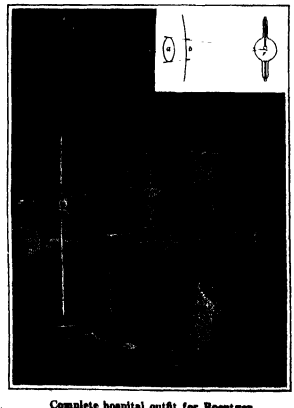
It is well known that X-rays differ in their power of penetrating different materials. This is commonly expressed by saying that they differ in "hardness." Now, X-rays of different hardness exhibit marked differences in their action upon tissues. In particular, it is found that the harder the radiation, the greater is the contrast in its action upon the several types of tissues. For this and other reasons which will appear later, it is highly desirable to use as hard rays as possible. In this connection Dessauer's most recent achievement is of special interest. It has been known for some time that the gamma rays of radium are of the nature of X-rays, but much more penetrating—at least twenty times as hard as the hardest X-rays known until recently. By means of a special tube with water-cooled cathode, Dessauer has quite recently succeeded in producing rays of hardness 1.2 expressed in units, in which gamma rays have hardness 1. As compared with the use of radium, an X-ray tube of this character presents the great advantage that it is capable of giving over one hundred times as much radiation as an ordinary radium preparation of 100-150 milligrammes. On the other hand, for internal application, radium offers obvious advantages, since it can, in many cases, be introduced directly into the part to be treated.

Homogeneity of Field of Radiation.

If the rays are to produce their specific effect on tissues of varying susceptibility, it is, of course, essential that the rays themselves, the field of radiation, be uniform. Thus, if a deep tumor is exposed to the comparatively weak radiation which has traversed several surface layers, while these surface layers themselves receive the full rays, obviously there may be intense and damaging effects produced at the surface, and only slight effects (which act as a harmful stimulant to growth, instead of destroying the tissues) at the greater depths.

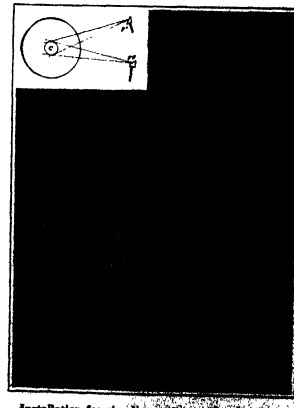
A lack of homogeneity in the doses of radiation given to surface and to deep structures may arise from two causes: First, owing to the absorption of radiation by surface layers. Secondly, owing to the fact that the intensity of radiation decreases rapidly with the distance from the source of the rays—the X-ray tube.

Now, each of these two contributing causes may be, in a measure, met by suitable precautions. The former, since the final source of inhomogeneity is due to the hardest rays obtainable, to the extent to which the tissues are transparent to these rays. The latter, by the use of a number of tubes, or by rotating the patient, or the tube, so that the rays shall pass through the tissues from many directions.



Complete hospital outfit for Roentgen Radiation.

The insert illustrates how, by placing anticathode *F* sufficiently far away, comparatively homogeneous radiation is obtained in structures *a* lying well below the surface *b*.



Installation for simultaneous treatment from two X-ray tubes.

The insert illustrates the method of treatment. *F*, *F*, anticathodes of two Roentgen tubes; *D*, region at which concentrated field is produced by crossed rays.

The Rodman Wanamaker Transatlantic Flier

Its Successful Trials on Lake Keuka

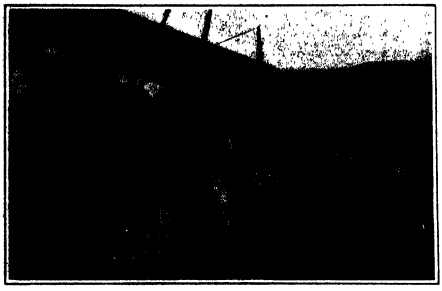
By Our Staff Correspondent at Hammondsport

The Rodman Wanamaker transatlantic flier, described in the SCIENTIFIC AMERICAN of June 27th, was christened the "America" by Miss Katherine Masson at Hammondsport, N. Y., on June 22nd, and tested the same day by Mr. Curtiss in her first flight, and later by Lieut. Porte, who is to pilot her across the ocean in July. Mr. Curtiss started the huge craft—of 74 foot spread, and weighing, with lightest load, something under 5,000 pounds—for a cautious run along the surface of Lake Keuka at 3:05 P. M., and played her about the lake for a quarter of an hour, to acquire familiarity with the controls. He piled the rudder, the elevator, the ailerons, turned curves in the water, throttled one of the engines to see the effect of an unbalanced thrust, and finally pointed her nose upward and rose on even wing with only part of her full power turned on. The vast throng of witnesses applauded with handclapping and tooting of automobile horns, but rather because it was the famous over-ocean flier, than because of any unusual appearance—the sight was all so natural and clock-like in its occurrence.

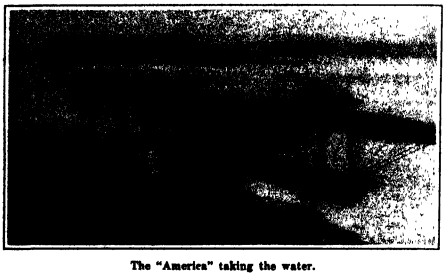
Mr. Curtiss, after three flights, one with Mr. George Hallett, who will be Lieut. Porte's assistant on the Atlantic flight, and one with Porte himself, came ashore. Then Lieut. Porte took the wheel, with Hallett in the seat, and a large machinist, Mr. Lamonte, in the engine section. The vessel flew very evenly, but with a slight tendency to nose up. This would be corrected later, to some extent, perhaps, by interchanging the engines, so that the blades of the twin propellers should rotate toward the hull while ascending, and thus lift somewhat on the tail plane by a slightly upward blast.

Lieut. Porte returned to shore beaming with satisfaction. He said it was the best machine he ever rode in. He had said, after the 30-hour test of the twin Curtiss motors, that these engines are the best in the world. He now thought, and Curtiss thought, that the Rodman Wanamaker flier must surely be equal to the work of carrying two men, without renewal of supplies, from St. Johns, Newfoundland, to the Azores, a direct distance of about 1,200 miles. The rest of the journey to England *via* the coast of Spain hardly gives them a thought.

Of especial interest was the test of the airboat's steadiness of course when the twin propellers gave unequal thrusts in flight. It had been said that if one motor should stop, the craft would spin around sidewise; but Mr Curtiss's consulting engineers had calculated the amount of turn of the vertical rudder that would keep her flying straight ahead with only one propeller pushing, and had found the rudder angle not excessive for a moderately prolonged voyage—rather under 15 degrees. The first trials seemed to bear out this estimate.



Christening the "America."

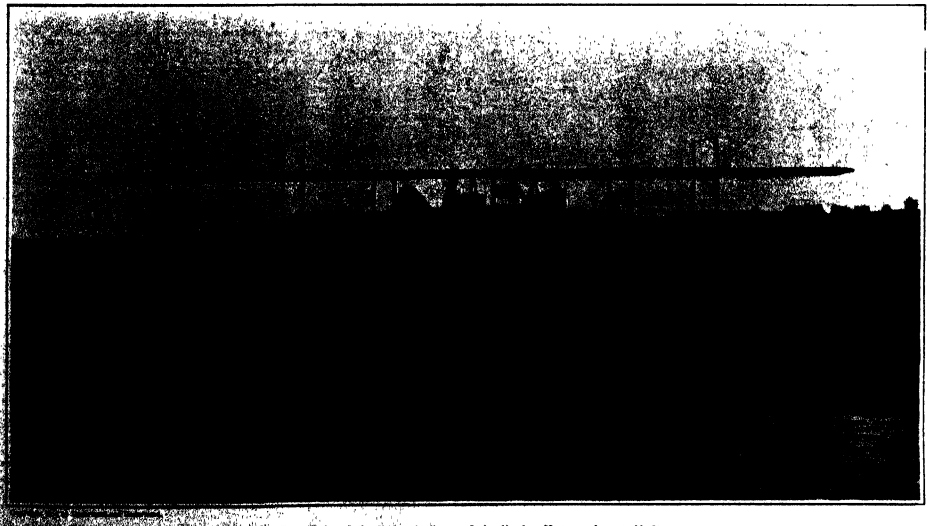


The "America" taking the water.

This test was only preliminary, for the total weight carried was three quarters of a ton short of the 5,000 pounds to be lifted at St Johns, and the engines, as shown by their separate tachometers, were running hardly above 800 revolutions per minute, instead of the 1,500 possible revolutions. Still, the craft planed at 40 miles an hour over the water, and at 50 miles an hour in the air, as estimated by Mr Curtiss, without instruments. She did not leak nor ship water. She planed well, rose promptly, was stable in the air and on the water, turned easily to right and left, and volplaned easily to the lake when the engines were shut off. No sharp or complete turns were made in these earliest flights on the narrow lake, but the turning will come easily.

Some changes and adjustments were found advisable. The aviators, sitting side by side in the windowed cabin, obstructed each other's view. Curtiss at once cut additional portholes on the side, to be covered with transparent celluloid, like the others. Side planes, jutting out from the hull to catch the water and help to lift the 2½ tons into the air, were to be added promptly.

Further experiments were to be made, extending through the week. Over 1,500 pounds of gasoline and oil were to be added. Two kinds of propeller were to be compared, and the most effective chosen. Every possible weakness was to be searched for in severe trials, and corrections made accordingly. Then the resplendent red queen of the ocean was to be sent to Newfoundland to make acquaintance of the Atlantic, and prepare for the momentous voyage. As these lines



The first flight of the "America" over Lake Keuka, Hammondsport, N. Y.

are written a fierce thunderstorm, tearing the boughs from the low-bending trees, has just passed over the aerodrome, drenching the dozen men who helped to restrain the airboat tugging at her moorings beside the lake, moorings made of heavy cable fastened to "dead men" or sleepers sunk deep in the earth This severe baptism, added to the dreadful battering she received during the christening, makes her quite a seasoned ship The champagne bottle used by Miss Masson, chosen at random from the two million in her father's cellar, in Hammondsport, was so thick and strong that, after two throws by her against the bow, and two violent throws by Lieut. Porte, it had to be tied and struck with a sledge before it would spray the hull. The "America" is now ready for the buffeting of the Atlantic

The Austrian Aircraft Disaster

By Carl Dienstbach

COLLISIONS in the air have occurred between aeroplanes, but the most recent disastrous encounter of a dirigible and a flying machine is a ghastly novelty, not only because of the appalling loss of life, but also because of its similarity to collisions at sea, which have resulted from imperfectly understood conditions of maneuvering The tragic sight of the occurrence near Vienna is not lightened by the fact that the military necessity of the kind of maneuvering from which it resulted was more imaginary than real, and that scientific thought could have revealed its dangers before they had been proved by bitter experience. Only obsolete dirigibles hold out a temptation for a sudden attack by aeroplanes from above at close quarters, a proceeding which has been characterized in the columns of the SCIENTIFIC AMERICAN as suicidal, even if it succeeds, and of which the danger has now been so glaringly brought home.

All large dirigibles are now provided with armored platforms as a defense against overhead attack, platforms which are reached by air-tight vertical passages with ladders, traversing the very gas But it is a serious oversight not to realize that the same defense may be easily improvised on any smaller airship of an earlier date. To see a man climb up the side, and even to the top of a spherical balloon—with the netting for a ladder—during inflation, to fasten a flag or adjust something is common enough, similar feats have been performed several thousand feet above ground. The weight of a small man with a Lewis machine rifle is still more easily supported by the tougher envelope and internal pressure of a dirigible. It requires only the lightest kind of a "saddle" frame (distributing the weight over a considerable area of fabric) to shelter the men very snugly and keep a rope ladder at a convenient distance of one inch or two from the gas bag, not to forget a speaking tube or signaling apparatus for communication with the car below. Although it is but a single marksman to whom the overhead protection of a small, old-fashioned dirigible be thus entrusted, his presence is quite sufficient to stamp any maneuvering of an aeroplane to get into efficient bomb-dropping range as equally ridiculous as assaulting with a dagger an expert with an automatic pistol If the upper half of the dirigible is deserted—a negligence quite as ridiculous in war as it would be to fight a torpedo-boat with no opening and a high fence on the starboard side—there is, indeed, a strong temptation for an attacking aeroplane to get into this lee-zone of invisibility When this was done without warlike intent by an aeroplane, which had gone out to greet an arriving Parseval dirigible, the experienced pilot of the latter published a passionate protest, "because nobody could know what might be the result." Assuredly, warlike conditions must needs increase the danger out of all proportion In the case of the ill-fated Austrian craft, it was evidently assumed that the dirigible was defended by firearms *in the car*. The tactics of the attacking aeroplane were, accordingly, correct enough from a military point of view, but a scientist could have foretold their risk. The newspaper report that the biplane rose to a much higher level just before attempting to fly over the dirigible seems correct, as close range fire could best be dodged by swooping.

But the maneuver resembled a landing, and Hirth, the German engineer-aviator, has eloquently described the chance of a premature contact with the ground, due to the difficulty of judging its exact distance, the amount of downward momentum, and, principally, how the contour of the ground might unexpectedly deflect the wind and sway the machine. The Austrian "Koerting," airship type, which figured in the accident, is characterized by a "camel-back," an exaggerated curving of the upper side of the hull, resulting in a tremendous suction like that above the upper surface of an aeroplane. We know what the "suction" of a hull of normal shape has done to ships on the water in bringing them into collision without any gravity to help. How much greater be that danger with one of them "all surface," like an aeroplane?

What happened to the unfortunate Austrian aviators was evidently that they felt themselves dropping into the worst kind of an "airhole" right above the dirigible. The slightest contact with the gas bag meant their inevitably firing a mine. The envelope had no more resistance to oppose the momentum than so much tissue paper. The uprush of the mass of hydrogen, liberated under pressure, is only too obvious.

But what no one seems as yet to realize is that it required no far-fetched "spark from the motor" to fire the explosive mixture generated as quickly as in a carbureter. In place of one spark, there were half a score of torches of blue flame spurting from the motor's exhaust. In daylight these are hidden from view, but in twilight they have frightened more than one passenger. (The first impulse of the dropping pilot was, naturally, to aid escaping by running his motor full blast.)

To the many reasons for carrying a muffler, this disaster has added a queer and ominous one. To "rush" a dirigible with open exhaust might be resorted to by those who want to die killing. But, with all its extreme vulnerability, the dirigible commands a protection like steel armor in its superior facility for the highest type of marksmanship. Aeroplanes should keep away from dirigibles when they need "elbow room," even in ordinary balancing. Whoever remembers small craft rocking in the wake of a steamer will be ready to grasp the fundamental truth that the invisible disturbance in the atmosphere from the huge bulk of a dirigible may extend to an unsuspected distance. If one remembers the danger to aeroplanes, even at a good height above them, of large detached buildings on the ground in a wind, the complication of a big dirigible, always of great inertia, an aeroplane, and possible wind gusts seem appalling, and the Austrian maneuvers more than foolhardy.

To extricate himself of well-nigh unavoidable miscalculations of the relative strength of momentum, gravity, and the uncertain amount of aerial support or resistance to be encountered near a dirigible, an aviator would need a reserve of propelling force that the most ingenious designer could hardly place at his disposal. Without it he could not possibly know just how long it would take to get about and be liable to bump into the dirigible when he felt most certain of dodging it. If speed is frequently miscalculated on the water, correct maneuvering in a "tight place" seems almost out of question in the air—unless flying machines be made, like birds, far more independent from inertia and momentum than are ships.

Ulivi's Experiments in Exploding Bombs With Infra-red Rays

THE press of Europe has much to say to-day about the experiments of the Italian engineer, Giulio Ulivi, who is said to be exploding bombs from a distance by means of the infra-red ray. The public exhibition in Florence a month ago, where four bombs floating on the surface of the River Arno were exploded in succession, has attracted much discussion. The SCIENTIFIC AMERICAN, in order that its readers may be in the current of popular opinion in the matter, presents an eye-witness story by a representative of the *Corriere della Sera* of Milan The accounts lack the precision of scientific ones and are defective in just those places that a physicist particularly desires more information, but they seem to present a matter that is taken seriously in some quarters. It is evident that there is here either a belief on the part of the experimenter in his results or a splendidly well-staged act in necromancy. It is well further to say that there have been previous "demonstrations" by another which have some resemblance to these. They have been regarded with suspicion in scientific circles.

Ulivi chose for his assistant, Admiral Fornari, who at 9 o'clock one evening was rowed from the iron bridge into the middle of the Arno, placing in the water one after the other the four bombs. The fact of the immersion was communicated to Ulivi by means of flashes of light, and the return of the admiral to the river bank was also signaled.

The lights served to notify the Florentines of what was on foot, and in great numbers they gathered on the Lungarno. The houses along the river were teeming with population, even to their roofs. Carriages, autos, and trams carried unceasingly their passengers to the river and streams of pedestrians had the same goal. Some went to Monte Senario, where Ulivi had stationed himself. Accompanying Admiral Fornari were officers and engineers invited by the Minister of War to view the experiment.

"All at once," according to the *Corriere*, "the darkness was rent by a blinding flash, there was an explosion with a shower of sparks and these lighted a cloud of smoke that for a while hung over the river." In a quarter of an hour the second bomb was fired, and after about an equal interval, the third. The bombs had been floating with the current and here a delay ensued. When about twenty minutes had elapsed the people thought that the last bomb had escaped, but near the bridge of the Grazie it was noticed and a formal detonation announced the complete success of the experiments.

It is represented that Ulivi wished to introduce the greatest difficulties and did not make up the mixture in the usual manner. He had already proved that glass and ebonite are transparent to the "calo-infinite" rays and employed other insulators. The powder was inclosed in a capsule of gutta-percha and this in glass, which another portion of the story suggests was waxed cord. Outside there was a sphere of porcelain, this incased in asbestos cardboard, and finally to inclose the whole, a jacket of wrought iron.

The bombs thus constructed could float about two thirds immersed. There is the claim that flotation is not necessary, and that the bombs could have been sunk to the bottom or buried in the earth without changing the results. But for such a public demonstration the safety of the spectators could be better assured by the method adopted.

The distance from the river to Monte Senario, where Ulivi stationed himself, is ten and one third miles, and intervening are Fiesoli and the plain of the Arno. When the signals were received that the bombs were placed and the admiral ashore again, the engineer began at once to send forth his "spy-rays."

The popular description of the devices employed suggests two operations, the sending forth of the electrical "spy-rays," which diffuse themselves in all directions, and the production of infra-red rays. Other items in the outfit are a telemeter, a wireless apparatus for messages, a voltmeter, an ammeter, and a chronometer. In addition there is a battery which furnishes the energy for the action of the apparatus.

In operating, the "spy-rays" are first sent forth. When they encounter a metallic mass they free from it what may be termed, "return rays." On analysis the latter indicate with some precision to the operator, who has his head incased in a telephone helmet, the amount of metal, its radio-magnetic effect and the distance at which it lies. The operator then directs the infra-red rays which he produces toward the metallic object. As they pass through it they produce scintillations, or as he terms them, "M-rays," which ignite the explosive.

If this story is really true, the possibilities are inconceivable. In offensive warfare Ulivi claims to be able to destroy forts, ships, and magazines, if they contain explosives, and practically eleminate war. On the other hand, if mineral veins or lodes can be thus detected there will be a most useful extension of the arts of peace.

Ulivi, born in Tuscany, achieved distinction at the Technical Institute of Florence, was made laureate in Germany, and established himself in France some years ago, and afterward set up a physical research laboratory at Clichy. In working with the infra-red rays of the spectrum, he discovered strange phenomena that these waves produced at a distance. He found that in a stable, some hundreds of feet from his laboratory, the iron horseshoes produced electrical scintillations when under the influence of the infra-red rays. He referred the phenomenon to comparable ones in the production by one musical instrument of sympathetic tones in another instrument. With this idea of sympathetic vibrations he experimented with light, electricity, magnetism, and heat, and the transformation of one into the other. The outcome of these researches has been the ability to explode charges that are within metallic walls. This explanation, although it is set forth as the presentation of the "fundamental theory," leaves much to be desired in the completeness and relevancy of its statements.

Meteorology in Eastern Siberia

THE new meteorological observatory at Vladivostok is to be the center of an extensive network of observing stations in Eastern Siberia, which will report their observations by telegraph, and co-operate in maintaining a storm-warning and general forecasting service. A grant of about $130,000 has just been asked from the Duma for the establishment and equipment of these stations. In connection with important colonization plans, the government of Yeniseisk has just published a large work (in Russian) on the climate of Eastern Siberia, accompanied by an atlas. This gives detailed statistics for most of the government of Yenisk, and the whole of the governments of Irkutsk and Transbaikalia. Increased knowledge of the Siberian climate is of practical interest to Americans in connection with the work of introducing plants from that region into the United States, and finding the most appropriate habitats for them in this country.

M. E. Durand-Gréville, the French meteorologist, died in Paris January 2nd, in his 70th year. His principal scientific work was the development of the law of squalls, and the bulk of his writings relate to this subject.

Correspondence

[The editor may not responsible for statements made in this correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Postage Stamp Mucilage

To the Editor of the SCIENTIFIC AMERICAN:

I read a very interesting article in one of your recent issues relative to the Government's new machine for the manufacture of postage stamps, and it occurs to me, in that connection, that something should be devised whereby these postage stamps could be so gummed that the stamps would adhere to the envelopes to their journey's end.

Seriously, we have great difficulty in this regard. The mucilage used is so light in character that it does not hold, and the slightest over-moistening of the stamps seems to take all the sticking qualities away.

New York. W. W. HALLOCK.

The Inventor of the Bicycle Prop

To the Editor of the SCIENTIFIC AMERICAN:

I wish to call your attention to the fact that the "Prop for Bicycles" shown in your issue of June 13th, on page 489, was patented by me on April 9th, 1895. For confirmation of this please refer to patent No. 537,147, where you will find description of this device, in what I think a much more practical form than that shown in your illustration.

I claim to be the oldest or longest continuous subscriber on your books. My subscription began in 1866 or 1867, and has been continuous ever since for the SCIENTIFIC AMERICAN. I am quite sure, too, that I began with the beginning of the SUPPLEMENT, and also the Building Edition. JOSIAH-B. GATHRIGHT.

Louisville, Ky.

The Foucault Experiment

To the Editor of the SCIENTIFIC AMERICAN:

Being a reader of your useful and instructive paper during a period of over fifty years, I always noticed that you are just, and invariably give credit to whom credit is due. Permit me, therefore, to mention and amend Mr. Edward Sillig's letter from Vevey, Switzerland, in your last edition, that the *second* "successful demonstration of Foucault's experiment," watching the world revolve, was made in 1854, at Carlsruhe, Germany, by W. Eisenlohr, professor of physics at the famous Polytechnic Institute, while I was a student there. The demonstration was made in a high church close to the professor's lecture rooms. The late beloved F. Redtenbacher, professor of mechanical engineering, advised in the construction of the *universal joint* from where the pendulum was suspended to swing independently of the earth's motion. ROBERT KUNSTMAN,

Little Rock, Ark. Consulting Engineer.

Sir Joseph Swan's Electric Incandescent Lamp

To the Editor of the SCIENTIFIC AMERICAN:

Allow me to call your attention to the fact that some erroneous statements were made in the article "The Death of Sir Joseph Swan," which appeared in a recent issue.

You state that Swan's "first lamp had a carbon filament." Such is not the fact, however. His first lamps had small *rods* of carbon for burners.

The famous lawsuits on the incandescent lamp in England and the United States were decided in favor of Edison, giving him priority over all others as the inventor of an incandescent electric lamp having a *filament* of carbon as a burner.

Orange, N. J. WILLIAM H. MEADOWCROFT.

Absence of Frosts on the Rand, Johannesburg

To the Editor of the SCIENTIFIC AMERICAN:

With reference to an article on a "Dumping Conveyor at the Brakpan Gold Mines, Johannesburg," in your most interesting and highly valued paper, (Vol. CX, No. 12, of March 21st, 1914), I beg to draw your attention to a statement in this article which reads as follows: " . . . . . The total absence of frosts in the Rand district does away with the danger of handling moist sand, which is always present in our own climate. . . . . " I am a South African born [not colored, please], and have lived ten years on the Rand (which word, by the way, i. e., Rand, means "Ridge," having been adopted from the Dutch), and have always *seen*, as well as *felt*, the very severe frosts up here—often accompanied by cutting winds and clouds of red dust, besides the white dust from the dumps; so it was with great surprise that I saw the above statement in your paper.

Now, as we subscribe from the Union (Government) correspondence, which speaks of the frosts up here:

"Frosts are experienced in Johannesburg and at Brakpan every winter, I believe, without exception. At the observatory we have had one or two winters without frost, that is, because of its peculiar situation. Our absolute minimum in the shade was 23.1 degrees on July 16th, 1906, and during last year the following are the minimum temperatures recorded from June to September: 31.5 degrees on June 8th, 1913; 31.2 degrees on July 15th, 1913; 27.5 degrees on August 14th, 1913; 30 degrees on September 4th, 1913, which will show you that frosts occurred in each of these four months.

"R. T. A. INNES, Union Astronomer."

In conclusion, I may add that we had about four inches of snow here about five years ago, and about eleven years ago the fountain in Johannesburg, Joubert Park, *was frozen solid*, long icicles hanging in the air!

M. D. WALES [Clerk of Court]

Krugersdorp, Transvaal Province, Union of South Africa.

Misinterpreted Wireless Signals

To the Editor of the SCIENTIFIC AMERICAN:

I have noticed with much interest the several letters that you have published under the heading "Correspondence" with reference to the misinterpreted wireless signals sent out by the steamship "Siberia" some time ago, and which, at the time, caused so much excitement in the newspapers.

I quite agree with Mr. Wiley that the call "M B S" might very easily be confused with "S O S," especially if one did not happen to hear the first letter or two after the attention signal. It seems to be natural, and a failing inherent in all operators, to run the letters of a call together, and as the station called is always able to recognize its own letters, no matter how much they may be run together, this ordinarily makes no difference.

However, the point I wish to make now is that I have searched the official list of radio-stations issued by the International Radiotelegraph Bureau of Berne, third edition, June, 1913, and all supplements that have been issued up to the present time, and fail to find any ship with the call "M B S," so I wonder whether or not, after all, the misinterpreted signals have really been explained! H A. FOWLER.

Kansas City, Mo.

How Vessels May Communicate With Each Other in a Fog and at Night

To the Editor of the SCIENTIFIC AMERICAN.

Like many others, my mind has dwelt on this fog problem at sea during the last few days. I have been familiar with electrical inventions all my life, and it does seem to me possible to perfect a simple device by which vessels at sea could be made aware of their proximity to each other. As I think it out, this device could be made to give almost exact information as to distance apart, and whether ships are approaching or moving away from each other.

I base my calculations on my attention to the impressions made by light and sound during thunderstorms I have often sat calculating the distance of the storm center, and measuring its approach and its passing, by the time distance between flash and thunder. A stop-watch started and stopped makes the calculations of distance quite accurate. In the case of the device I have in mind, I would make the wireless dot or dash take the place of the lightning flash. While the lightning flash could not be seen through a fog, the wireless and sound waves would not be affected.

Suppose a whistle, fog horn, or gun so connected with the wireless operator's instrument that the touching of his key would release at exactly the same instant the spark for the wireless instrument and the sound of whistle, horn, or gun. The operator on the other ship would receive the wireless instantly, just as I received the lightning flash, while the sound would follow at the comparatively slow rate of about 1,100 feet per second, as the sound of thunder. For every second between the receipt of the wireless spark and the receipt of the sound the operator would know that there was 1,100 feet of space between the vessels. A signal of this kind sent out once every ten seconds would cover a radius of nearly two miles. The velocity of the wind would make a difference not difficult to calculate.

To give exact information as to approach or separation of vessels, the following device could be used. Devise an instrument to be worked like a stock-ticker with traveling ribbon. Arrange that this ribbon shall travel at, say, the rate of one inch per second. Each inch would represent 1;100 feet of sound travel The ribbon could be scaled off to represent shorter distances if necessary. Then arrange a series of dots or dashes to represent on this ribbon the receipt of the wireless waves and sound waves. As vessels approach each other, or as vessels approach wireless land stations, the dots and dashes would indicate the fact by crowding up together on the ribbon. For instance, if the signals were first received at a distance of two miles, the dots or dashes would be about ten inches apart on the ribbon; when a mile apart this distance would be represented by a space of five inches between dots or dashes, and so on. As vessels move away from each other, or from a wireless station on shore, the dots and dashes would thin out on the ribbon If the vessels were moving in the same direction, alongside, the dots and dashes would remain an equal distance apart. If such an instrument could not be operated by the wireless or sound waves, the wireless operator could easily manipulate it through his own sense of hearing. I believe that the use of this method would enable a vessel in distress to guide a rescuing vessel alongside, no matter how black the night or thick the fog.

Any navigator could send a signal of this character without special apparatus other than the wireless For instance, the captain could instruct his wireless operator to send a signal the instant the whistle begins to blow The operator on the other ship could report back the time interval between the receipt of the wireless and receipt of the whistle, which would give the distance separating the ships exactly The distance could be calculated as so many seconds and fractions of seconds, each second being equivalent to 1,100 feet.

I have talked with a number of people on this subject, and the prevailing opinion seems to be that my idea is practicable, and can be worked out If you think this scheme would stimulate other minds to action in solving the fog problem, I have no objection to your publishing it. It would be far better to have hundreds of minds working on this problem than perhaps only a few. J. B WEST.

Syracuse, N. Y.

The Pioneer Steamship in European Waters

To the Editor of the SCIENTIFIC AMERICAN

In your interesting article, "The New Cunarder Aquitania," in the June 6th issue of the SCIENTIFIC AMERICAN, I noticed you mention "the launch of the pioneer steamship in European waters—Bell's 'Comet,' which was launched in 1812."

On a table in the Merchants' Exchange, in San Francisco, there reposes in a glass case a worm-eaten fragment of oak, bearing a legend stating, in effect, that it is a relic of the "Charlotte Dundas," a steamboat built at Grangemouth, Scotland, and launched in 1801 by William Symington. She was a sternwheel boat, about fifty-seven feet long, the wheel being inclosed in a case at the stern, and was employed in towing barges on the Forth and Clyde Canal Her speed was about eight miles per hour She antedated Bell's "Comet" by eleven years and Fulton's boat by six years. The "Charlotte Dundas" was a distinct success, but owing to certain hostile "interests"—there seem to have been "interests" even in those days—she was withdrawn from active service

It is one of the fallacies of history that Fulton was the pioneer in steamboat construction. He was present at the trial trip of the "Charlotte Dundas" in 1801, and did not launch the "Clermont" until 1807. In fact, some of the material of which the "Clermont" was built was shipped to Fulton from the same yard where the "Charlotte Dundas" had been built six years previously.

A steamboat was launched on the Delaware by John Fitch, in 1787, I believe, but did not prove a success. To whom belongs the honor of first conceiving the idea of a vessel propelled by steam is difficult to say Pepin, a Frenchman, is said to have experimented with one on the Seine some time in the seventeenth century, but there is little doubt that William Symington was the actual pioneer in practical steamboat construction Recorded facts will, I am sure, verify these statements.

San Francisco, Cal. A. E. ACKLOM

[Although Fulton in America, and Bell in Great Britain were the first to inaugurate a successful passenger-carrying service in their respective countries, Symington, with his "Charlotte Dundas," built the first successful steam tug, and this as early as 1801. Furthermore, had Symington received the necessary backing, we have no doubt he would have been the first to build and operate a successful passenger steamship. That he was a skilled and qualified engineer is shown in the excellent design of his tow-boat This vessel and other pioneer boats, such as that of Fitch, were illustrated and described in our Hudson-Fulton issue of September 25th, 1909.—EDITOR.]

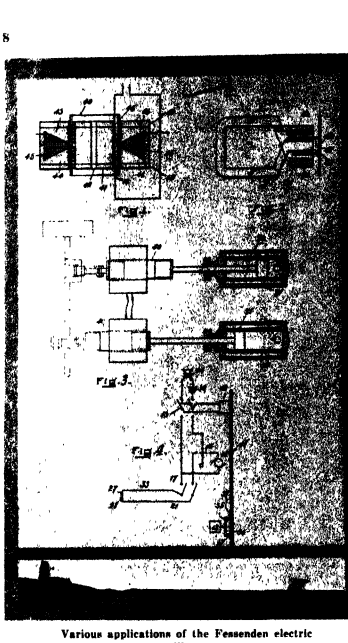
What Power Does It Take to Stop an Automobile?

To the Editor of the SCIENTIFIC AMERICAN

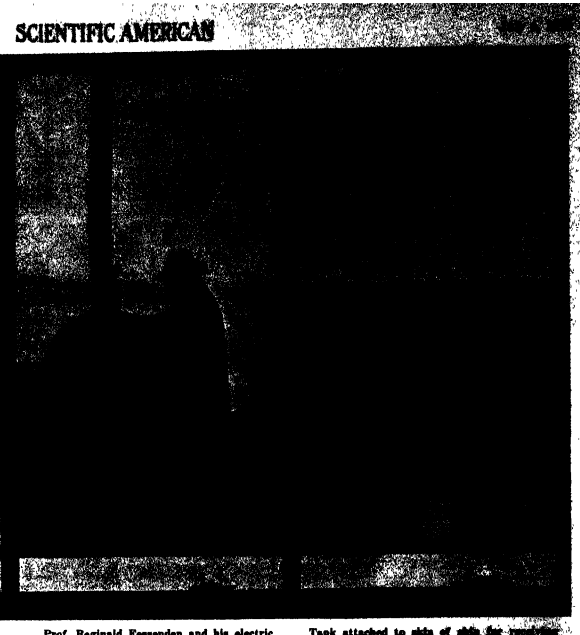
Please state in some intelligible figures what it will take, in weight or power, to stop an automobile weighing 3,500 pounds, traveling 20 miles an hour, within 30 feet. X. Y. Z.

New York

[Simple as the problem propounded by our correspondent is, it is curious how many different solutions are given by persons who are presumably familiar with the principles of physics. We shall be glad to hear from our readers on the problem.—EDITOR.]



Various applications of the Fessenden electric oscillator.



Prof. Reginald Fessenden and his electric oscillator.

Tank attached to skin of ship for transmitting submarine signals.

An Underwater Siren to Prevent Collisions at Sea

Prof. R. A. Fessenden's Latest Invention

By P. Harvey Middleton

BEFORE describing the oscillator invented by Prof R. A. Fessenden, which has made it possible, for the first time in the history of navigation, for moving ships to communicate with each other in the densest fogs with absolute certainty, and to obtain an echo from an iceberg, it is necessary to recall briefly the history of the submarine bell, which first made it possible for ships to receive sounds through the water, though not to send them. Jules Verne in his "Twenty Thousand Leagues Under the Sea" makes Capt Nemo of the "Nautilus" dwell upon the superiority of submarine transmission, and there have been many attempts to utilize the principle; the natives of Ceylon over a hundred years ago used to signal each other when at sea by submerging an earthen "chatty," which, when struck, produced a sharp, percussive clink that could be heard by placing the ear against the bottom of a boat miles away After persistent and long-continued experiment in the utilization of improved electrical microphonic and telephonic apparatus, the first submarine bell was installed at Egg Rock, on the Massachusetts coast, in 1901, and three years later the first receiving apparatus was fitted upon an ocean-going steamer. Now there are 148 bell stations in the world, and 1,225 war and mercantile vessels have apparatus for receiving the sound from these bells, this apparatus consisting of (1) an indicator box containing switches for connecting alternately the microphones of the system with the telephone receivers, (2) dry batteries for supplying electric current for the telephones, (3) microphones for transmitting the bell sounds to the telephone, and (4) tanks to contain water in which the microphones are immersed.

The man who deserves the highest credit for the idea of installing a microphone for transmitting sound in a tank on board ship is the late Arthur J. Mundy. Realizing that sound travels through water at 4,700 feet per second, against 1,090 feet through air, and that submarine signals are not subject to interferences such as frequently occur with atmospheric sound signals, Mundy conceived the idea of building a tank on board ship in such a way that the hull would form one end of the tank, which was filled with sea water, the side of the ship offering no impediment to the passage of sound through the water.

But the problem which still remained, and has only now been solved, was to devise an apparatus that would send out powerful signals from a moving ship, and of a selective receiving apparatus which would make it possible for the ships of a fleet or merchant vessels to signal each other without interference. You see, the existing submarine bell only made it possible for a moving ship to hear the sounds made by a stationary bell or a stationary ship. The one thing which all ships have lacked has been a means of making a noise in the water, while in motion, which other vessels could hear, and by which they could locate each other, irrespective of weather conditions

There have been many attempts in the past five years to invent something which would create a powerful enough sound in a tank on board ship to penetrate through water at considerable distances. Prof. R. A. Fessenden has now perfected an oscillator which can be attached to the inside hull of a ship below the waterline, and which produces a sustained note of any desired pitch. It is controlled electrically, and by using an ordinary telegraphic key, messages can be sent by the Morse alphabet. Moving vessels can now communicate with each other and exchange signals under water at considerable distances in the thickest fogs, as well as receive signals made by bells on buoys, lightships, or ships at sea It will do in fog what light does in clear weather—tell a ship where the danger is, in ample time to avoid it.

Patents have been applied for and granted in several countries. The following description of the apparatus is taken from the French patent:

The Principles of Prof. Fessenden's Oscillator.

Prof Fessenden's oscillator serves to produce, utilize, transmit, or receive compressive waves, such as are employed in the transmission of submarine signals.

Fig. 1 is a sectional view of an electrodynamic oscillator built according to Prof. Fessenden's plans, and intended to act either as a motor or as a generator. Fig. 2 is a diagram of a telephone receiver in which the principle of the invention is embodied, but the field of which is produced by a permanent magnet. Fig. 3 is a diagram showing the mode of energising the oscillating conductor by means of a gas engine. Fig. 4 is a diagram showing the invention applied to the transmission and the reception of submarine signals.

In Fig. 1 the oscillating conductor 40 is shown in the form of a copper cylinder, and 45 is the magnetizing coil of an electromagnet, having north and south poles, 43 and 44. The central core is indicated by 41. Figs. 46 and 47 indicate the two windings of the stationary coil, constituting one of the elements of the transformer (of which the oscillating cylinder 40 constitutes the other) and connected with an external circuit.

The magnetic flux passes from the pole 43, through the cylinder 40 to the upper half of the armature or core 41, thence from the lower half of the core to the pole 44, and by way of the external ring, back to the pole 43. That part of the cylinder 40 which extends beyond the two windings 46, 47, is vertically grooved or otherwise formed to attain high resistance. The coil 46, 47 is preferably wound on the core 41, although it might be placed within the poles 43, 44. The upper and lower windings of this coil run in opposite directions, so that the current induced in the cylinder 40 may by such that the force exercised on the upper and lower parts of the cylinder will be of the same sign. Hence, the cylinder 40 can always be cut into two halves, and the windings 46, 47, can be given the same sign; the two halves of the cylinder then move in opposite signs, so that no unbalanced inertia effects will be produced.

The core 41 and the poles 43 and 44 are preferably grooved vertically, in order to avoid eddy currents. The plates 48 and 49 serve to hold the pole pieces of the electromagnet and the core together. The core 41 is provided with an opening 42.

When an alternating current having a frequency of 1,000, for example, is passed through the coil 46 and 47, the cylinder 40 acts as a short-circuited secondary, in which is induced the same number of empire turns as in the coil. Because of the gap, which may have 15,625 lines per square centimeter, the current is not just sufficient to be lowered with great force, the path being of very limited length. If the side of a ship or the rod of a hammer-piston were fixed to the extremities of the cylinder 40, they would be thrown into movement.

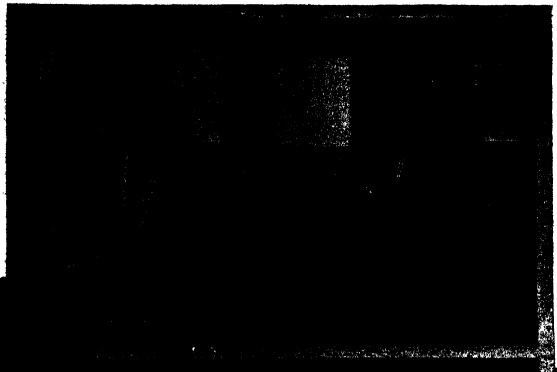
The motor, in this form, has this great advantage over all other alternating current motors; as a result of short-circuiting the cylinder 40 out of the influence reaction on the coils 46, 47, there is no appreciable inductance, no eddy currents in the electromagnetic metal. At a frequency of 1,000 and a resistance of 1 ohms for the windings, 46 volts are sufficient to make 20 amperes through the circuit, consuming only 920

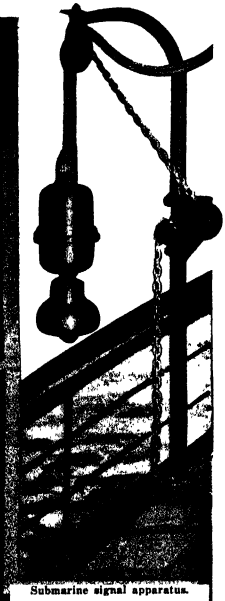
duction of submarine signals. If the flux is 15,000, the circumference 60 centimeters, and the amperes 24,000, the total force will exceed 2,032 kilograms. The cylinder will weigh about 5 kilograms, and such a force applied to this mass will give an acceleration of more than 4,000 meters per second. If, then, this force is applied to the given mass for a second, the speed obtained will be more than four times as great as that of a projectile discharged from a gun with ordinary powder. This power is of a very different order than that which has hitherto been obtained, and it is

Receiving a submarine signal.

Chart room of the "James S. Whitney" of the Metropolitan Line, running between New York and Boston. This shows the indicator box, by means of which the officer can compare the bell sound on the starboard side with that on the port, by turning a switch, which disconnects one side and connects the other. There are two ear-pieces, so that an operator may have a receiver at each ear, or two operators can share the service, so as to correct their observations. The Fessenden oscillator will be connected to these indicator boxes. The "James S. Whitney" was one of the steamers used in submarine signal experiments conducted for members of the United States Lighthouse Board

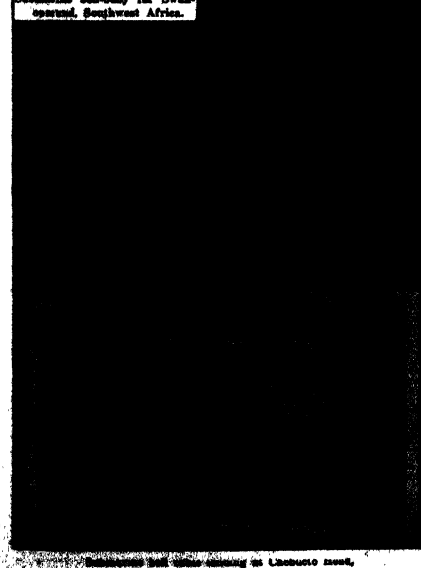


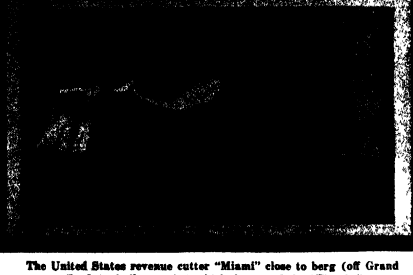




Submarine signal apparatus.

Outboard gear installed on a lightship. The bell hangs down 25 feet under water





The United States revenue cutter "Miami" close to berg (off Grand Banks) similar to that which destroyed the "Titanic."

The Fessenden oscillator obtained echoes from icebergs two and a half miles away, distance being determined by stop-watch. Had the "Titanic" been equipped with an apparatus capable of ascertaining the presence and distance of the iceberg, she might have been saved.

possible only because of the powerful connection between the two elements of the transformer. The time constant is very small, because of the feeble self-induction of the oscillator, due to the mutual neutralizing action of the primary and the secondary.

In Fig. 2 another construction is shown, adapted for telephone use. The diaphragm of the telephone is indicated by 60; 61 is the cylinder or oscillating tube. *N.S.* is a permanent magnet, one of the poles of which constitutes the core 62, and the other pole 63 is of a circular form and incloses the stationary coil 64. In this case only a single gap is employed, since the magnetic lines pass between the pole or central core and the exterior concentric annular pole. When the currents coming from a microphone pass through the coil 64, the tube 61 vibrates, and the diaphragm 60 to which it is fixed reproduces the sound.

Fig. 3 is a diagram of the oscillator in the form of an alternating-current generator, two connected oscillators being energized by two pistons 71, acting in opposite directions in the cylinders 70, and each piston being connected with an oscillating cylinder 40. When a certain number of these units is employed, they can be connected in parallel, and the synchronization is such that neither a crankshaft nor a flywheel is necessary; control is effected simply by regulating the ignition. In adopting this novel construction an obstacle is overcome, which prevents the employment of oscillating dynamos, that is to say, the carrying along of the lines of force with the movement of the conductor. This is true to such a degree that the telephonic receiver shown (Fig. 2) is much more sensitive to equal movements than any carbon microphone. The absence of this carrying along of magnetic lines and of inductance and hysteresis adapt it splendidly for syntonization. Such microphones can be connected in series or in parallel, which cannot be done with carbon microphones, because of the difference in phase.

Fig. 4 shows the application of the oscillator for submarine signaling. The apparatus is mounted directly on the plating 11 of a ship. If preferred, a diaphragm may be inserted in an opening made in the side of the ship, or the diaphragm may be fixed to the side of the ship, within the hold, the space between the diaphragm and the side of the ship being filled with water or with some other liquid, such as oil, which can be put under pressure. Instead of a liquid, a compressed gas can be employed, such as air or carbon dioxide. This diaphragm 35 is shown fixed to the inner side of the plating 11 of the ship; 36 is the fluid, and 37 a rubber guard ring. The diaphragm can be so constructed that, when it is touched, it will vibrate for some time. The apparatus 12, mounted on the plating of the ship, is similar to that shown in Fig. 1. When the switch 13 is thrown and the key 16 is depressed or moved to the right, the current from the alternator, or from the source of intermittent current 15, passes into the apparatus 12, and causes the cylinder 40 (Fig. 1) to vibrate powerfully. The cylinder being fixed to the plating 11 of the ship, directly or indirectly, as when it is mounted on the diaphragm 35, or secured to a rod or a spring, produces in the water, outside of the ship, compressive waves similar to acoustic waves in the air, which are transmitted and received at the receiving station. The waves thus transmitted may be of any desired frequency, from five to several thousand per second. In practice, the frequency is preferably determined by the frequency of the source 15. The key 16 may be employed for signaling, as in the case of ordinary telegraphy. When the switch 13 is raised, the apparatus 12 is placed in circuit with the battery 38 and the regulator 14, which may be a carbon telephone transmitter in which strong currents are used, or a transmitter and relay.

Telephonic communication through water is effected by speaking into the transmitter 14. When the switch 13 is lowered and the switch 17 is raised, and when the key 16 is raised (moved to the left), the apparatus 12 is connected with the receiving circuit. In this position, when the compressive waves coming from some other station, are projected against the side 11 of the ship, they move the plating carrying with them the cylinder 40, and the movement of this cylinder generates in the coils 46 and 47 (Fig. 1) currents which actuate the receivers 27 and 28. The current entering at the right side of the switch 17 and of the switch 21 passes through the receivers 27 and 28, which are in series, and returns through the conductor 33. Instead of switches, one may use the ordinary telephone circuit of land lines.

Some Remarkable Tests.

The first tests of this oscillator were made on the battleship "Delaware" in March, 1913, later tests being carried out on the United States submarines "D-2" and "D-3." The sound is produced in the oscillator by the vibration of the diaphragm, this motion being given by electrical impulses induced in a copper cylinder inside the casing, which hangs free in an electromagnet. The accompanying diagram shows the principle clearly. The motion, only 1/100th of an inch in length, is given at the rate of 500 per second, making a musical note. The receiving oscillator is precisely like the sending one, the action being merely reversed, and the diaphragm exciting the telephonic apparatus within as it receives vibrating the telephonic apparatus within as it receives vibrations from the water. In regular service the oscillator will either be attached to the side of a tank on board, filled with sea water, the side of the ship forming one end of the tank, or else it will be set in the side of the ship as a diaphragm, that is to say, a hole will be cut in the side of the ship as large as the oscillator, and the latter will be set right into the hole.

On June 3rd a test was made in sending messages from the collier "Devereaux," off Cape Cod, to the "Neponset" tug, lying off Boston Lightship, with Prof. Fessenden on board the latter. The "Neponset" was equipped with a receiving oscillator, hung overboard from a davit. About 9 30 P. M. the unmistakable note of the oscillator on the "Devereaux" was heard, carried under water all the way across Massachusetts Bay, her distance being approximately determined by the volume of sound received. The Morse dot-and-dash sounds could be heard perfectly in the forecastle of the tug, beneath the water-line, even without the aid of the receiver at the ear. The steamer "King Philip," nearby, with a fishing party on board, came over to the lightship, her captain much mystified, because his men in the forecastle reported hearing dots and dashes coming from an unknown quarter.

Earlier on the same day an even more surprising demonstration had been carried out with two tugs tethered in tandem fashion to the Boston lightship, communication having been established by the sound of the human voice transmitted under water—the first successful experiment of wireless submarine talking. The distance, of course, was very short, but Prof. Fessenden has high hopes of its further development.

On June 10th the writer met Prof. Fessenden in Boston, and witnessed a demonstration with an oscillator attached to the end of an oblong iron tank filled with water, there being an open space of about eight inches between the oscillator and the tank, a wire running from the oscillator to a Morse telegraph key on a table. The professor tapped out a message on the key, and the vibrations communicated to the tank were so powerful that the water sprayed up from the four sides like a miniature fountain, the note produced being almost deafening in the small room. Then the professor shut himself up in a small office at the far end of the workshops, and placed a Melba record on a talking machine, the writer remaining in the room with the oscillator. Immediately the strains of "La Serenata" ascended apparently from the center of the tank, and when the ear was placed on the iron side of the tank, the voice came clear and distinct, apparently through the metal. As a final experiment, Prof. Fessenden asked the writer to go into the room at the end of the shop, close the door, and listen at a telephone receiver hung on the wall, while he stood in front of the oscillator and delivered a short speech. In this case, too, the voice was clear, though seeming to come from a long distance.

Prof. Fessenden declares that the oscillator's note has already been heard thirty-one miles through the water, and its note cannot be mistaken for the sound made by any screws, machinery, or bell.

Disasters That Could Have Been or Were Averted by the Submarine Signal.

The United Fruit Company's steamer "Turriaiba" went ashore off the New Jersey coast within a mile of a large gas buoy which could not be seen in the snowstorm. That ship had submarine signal receiving apparatus, but the Government had failed to equip the buoy with a bell. The "Uranium," wrecked near Halifax, passed within two and one half miles of the submarine bell at Chebucto Head. She was not equipped with receiving apparatus. The passengers, in both cases, had a narrow escape from drowning. The steamer "Rosecrans," mistaking in the fog the North Head Light for the Columbia River Lightship, was wrecked at Peacock Spit. The lightship was equipped with a bell, but the steamer was not equipped with receiving apparatus. Thirty-two people were drowned, and the survivors suffered untold hardships. These wrecks were all unnecessary. Had the Government in the one case and the steamship companies in the other performed their obvious duty, no wreck would have occurred.

Nowadays each submarine in the United States Navy carries both bell and receiving apparatus. In a test at Newport, when the submarine "Octopus" was running under water, a tug crossed its course, paying out towline, which lay directly in the path of the submarine. It was only a matter of moments before she would have been wrecked by the lawsuit, when her tender signaled her to come to the surface. She instantly obeyed, and escaped almost certain destruction. The French submarine "Pluviose," while maneuvering outside Calais Harbor, arose to the surface directly in front of a cross-channel steamer, and was sunk with all her crew of twenty-seven. Had she been equipped with a submarine signal, she would have heard the approaching steamer in time to avoid a collision.

In future, the vessel approaching another will not only hear the oscillator, but will also hear the sound made by the water which can be heard on board any vessel within a radius of several miles, even if those submarine signals are without receiving apparatus, for the sound made by the oscillator is so strong and penetrating that it will pass through the hull of any craft on the surface, and can be readily heard in the open air.

The Fessenden Oscillator Obtains an Echo from Iceberg.

After the "Titanic" disaster, as the result of the London Conference, the International Ice Observation and Ice Patrol Service was started, and the United States revenue cutters "Seneca" and "Miami" were detailed to relieve each other as patrol vessels in locating floating ice and field ice nearest to the transatlantic steamship lanes. Prof. Fessenden and R. Fulton Blake, accompanied the "Miami" on her first cruise (April 15th to May 1st, 1914), and the following extract from the official report of her Captain, Commandant J. H. Quinan, illustrates just how the oscillator might have prevented the "Titanic" disaster:

"We stopped near a large berg, and by range-finder and sextant computed it to be 400 feet long and 120 feet high. Although we had gotten within 150 yards of the perpendicular face of this berg and obtained no echo from the steam whistle, Prof. Fessenden obtained satisfactory results with the submarine electric oscillator placed 10 feet below surface, getting distinct echoes from the berg at various distances, from one half mile to two and one half miles. These echoes were not only heard through the receivers of the oscillator in the wireless room, but were plainly heard by the officers in the wardroom and engine-room storeroom below the water-line. The distance of the ship, as shown by the echoes with stop-watch, corresponded with the distance of the ship as determined by range finder. . . . On the morning of April 27th, anchored in 87 fathoms of water, Prof. Fessenden took advantage of the smooth sea to further experiment with his oscillator in determining by echo the depth of water, the result giving 86 fathoms, which seemed to me very close. . . ."

An Aerodynamic Balance

At the recent Conversazione of the Royal Society, an aerodynamic balance was exhibited, designed for the experimental investigation of the stability of aeroplanes. The main part of the balance consists of three arms mutually at right angles, each arm being counterbalanced. These arms meet in a point at which a steel center is fixed, and the weight of the balance is taken on this point. The vertical arm passes through the under side of a wind channel and supports the model under test. The horizontal arms are arranged respectively parallel and at right angles to the wind direction. The arrangements allow of the measurement of the forces on the model along three fixed rectangular axes, and also of the three moments about these axes for any angle of incidence of the wind on the model. The instrument is made to the design of the staff of the National Physical Laboratory, and was exhibited by the courtesy of the directors of the Aeronautical Department of the Massachusetts Institute of Technology, for whom the instrument has been constructed.

The Current Supplement

In this week's issue of our SUPPLEMENT, No. 2009, Sir William Willcocks of Cairo, Egypt, draws lessons from ancient Egyptian practice, which he embodies in a most interesting article, "How the Ancients Would Have Controlled the Mississippi."—P. D. Bauham gives directions for building a novel yacht.—Alexander Siemens discusses the advantages of the metric system.—In an article on safety at sea, some of the signals which figured in the testimony at the inquest on the "Empress of Ireland" disaster are described and illustrated.—In an article on metallic colloids and their bactericidal properties Henry Crookes makes some interesting comparisons regarding the size of microbes and of colloid particles.—In a valuable paper, entitled "New Light on the Structure of Matter," Arthur H. Compton gives an account of recent researches, in which X-rays are used to disclose the arrangement of atoms and molecules in crystals.—Richard W. Allen writes on modern pumping machinery and for the drainage of the Fens, England.—Prof. Svante Arrhenius took for the subject of his recent Tyndall lectures "The Identity of Chemical and Biochemical Laws." A summary of his remarks appears in this issue.

A Danish North Polar Expedition will probably go north next summer, under the leadership of Knud Rasmussen, who is well known for his geographical and ethnographical explorations in Greenland, and for his remarkable journey across the northern extremity of the Greenland ice-cap in 1912. The party will establish its base at Cape York, Greenland, and will be provisioned for two years. The funds for this undertaking have been provided by Otto Olsen, a Danish millionaire.

The Manufacture and Fitting of Piston Rings

How the Efficiency of a Motorcar is Dependent Upon Gas-tight Ring-joints

By H. S. Whiting

If the valves of the gasoline motor are the sentries placed on guard at the entrance to and exit from each cylinder to make certain that the mixture follows its proper course at the proper time, the piston rings are the walls or ramparts that confine the gases within their well-defined limits.

Piston rings have well been termed "power dams." If the dam leaks, so that a portion of the inflammable gases or the force of the expansion due to the explosion escapes, power will be wasted. The proper fit of the rings, therefore, becomes a matter of dollars and cents to the owner, for a loss of power means a waste of gasoline.

Inasmuch as the piston moves in the cylinder, the one cannot be a tight fit in the other. It is a difficult matter to obtain a freedom of motion and a gas-tight joint at the same time, and the high temperatures found in the cylinders of an internal combustion motor complicate matters somewhat. Allowance must be made for the unequal expansion of the uncooled piston head and the water-jacketed cylinder walls, and therefore a clearance of one or two thousandths of an inch must be allowed. Insignificant as this space may seem, it is nevertheless sufficient to allow the escape of nearly all of the mixture at each compression stroke, and therefore some means must be provided to form a gas-tight joint.

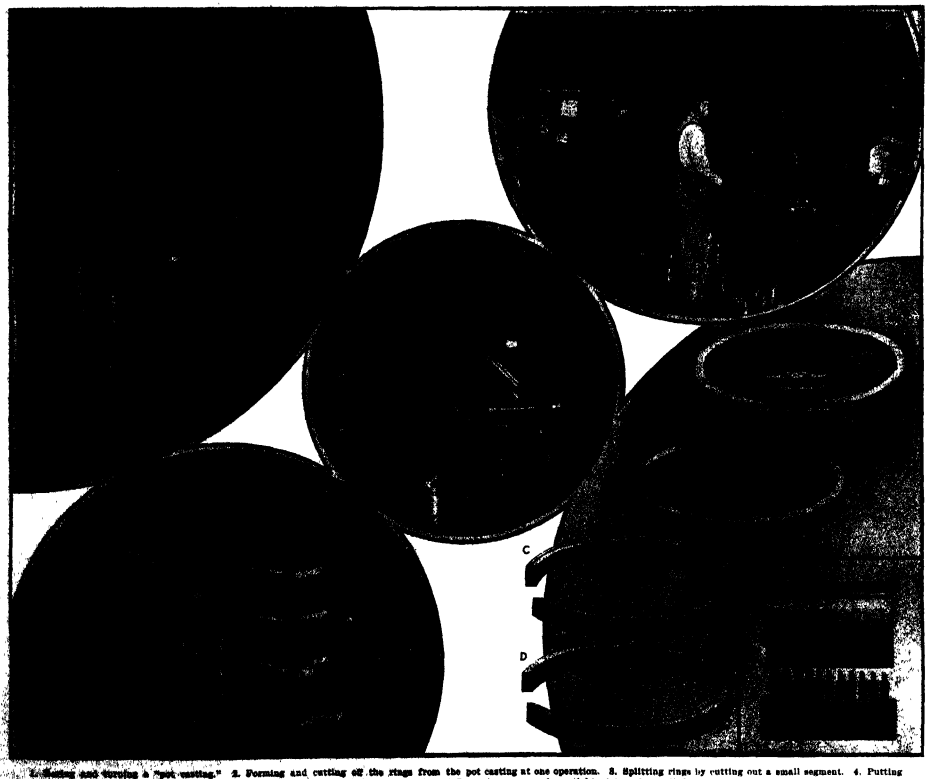
This is the function of the piston ring, and whether it—together with its two or three companions in each cylinder—performs its work ill or well depends upon many features of material, construction, application, and fitting. Evidently a more or less elastic packing must be used, to allow for the slight expansion and contraction of the cylinder walls, caused by the variations in temperatures. A fibrous material would possess neither the strength nor the heat-resisting qualities necessary to retain the powerful hot gases within their confines, and therefore metal rings are used exclusively. It might seem that a high-grade steel of the same kind as that of which springs are made would answer these requirements, but while such a material would possess the proper elasticity, its extreme hardness would soon wear the iron cylinder walls, regardless of the amount of lubrication that might be applied. It has therefore been determined that the same fine, gray, cast iron of which the cylinders are made forms the best all-around material for piston rings, although special alloys have been used, with varying degrees of success. It is the practice of some manufacturers who make a specialty of piston rings to employ a quality of gray iron somewhat softer than that from which the cylinders are cast, in order to make certain that whatever wear occurs will be on the easily-replaced rings rather than on the more expensive cylinder casting.

Not only must the piston rings be elastic, in order to conform to the size of the cylinder bore, and press tightly against the walls at all points, but they must be sufficiently flexible, so that they may be forced on over the piston when they are to be placed in their grooves. This means that the inside of each ring is expanded to the normal diameter of the outside, and it is under these conditions that a ring is most liable to break, due to the strain induced at a point directly opposite the joint. Consequently the greatest care must be taken when removing or applying a ring to make certain that it is not expanded beyond the size necessary to enable it to be slipped on over the piston.

Inasmuch as the ring must be flexible, so that it may contract or expand, it cannot be a continuous ring, or circle. This split, or joint, is really one of the most important parts of the piston ring, for upon its formation and fitting depend the gas-tight qualities. The simplest form of split is the straight, diagonal cut. But this is not as efficient as the joint formed by a rectangle cut from diagonally opposite corners of a straight slot, thus forming overlapping tongues. The adjoining vertical surfaces of this joint cannot always be in contact with each other, as it is the movement of these points that allows for the necessary contraction and expansion of the ring. The overlapping horizontal surfaces, however, can be finished to a comparatively tight fit.

As the greatest danger of leakage in a well-fitting piston ring lies at the joint, the three rings of a piston are generally so placed that alternate joints lie diametrically opposite each other. Thus, gas escaping beyond the joint of the first ring is prevented from passing directly by the piston, but must be deflected several times in order to reach all of the joints. In order to keep the respective rings in their proper positions, pins are oftentimes inserted in the grooves, to serve as a stop for the ends of the joint. But it is not often that all of the rings—even though unpinned—would work

(Concluded on page 17.)



1. Making and turning a "pot casting." 2. Forming and cutting off the rings from the pot casting at one operation. 3. Splitting rings by cutting out a small segment. 4. Putting in the hoops just in a double ring, to keep the parts in relative position. *A*, *B*, *C*, and *D*, various types of gas-tight piston rings; *E*, how a gang of tools for cutting rings out of a pot are set to come successively into action.

The making of gas-tight piston rings.

The Heavens in July

Are Comets Visitors, or Do They Belong to the Solar Family?

By Henry Norris Russell, Ph.D.

AMONG the astronomical publications of the past month one of the most interesting comes from Copenhagen, and deals with the much-discussed question of the origin of comets.

Ever since it was found that most comets move in nearly parabolic orbits, and must have come from a distance many times greater than that of the remotest planet of the solar system, it has been a question whether they really belong to our system at all, or are visitors from outer space. This is not an easy question to answer and the definite assertion which Prof Strömgren is now able to make, in the memoir just mentioned has only been made possible by skilled mathematical analysis and laborious computations, but the principles on which his work has been done are simple enough to explain here.

All students of astronomy know that the orbit of a comet (or of any other body moving freely under the force of the Sun's gravitation) may be an ellipse, a parabola, or a hyperbola. In the first case, the orbit is a closed curve. If we could follow the comet's motion as it receded farther and farther from the Sun, we would find that the rate of its recession grew ever slower and slower, until at last the Sun's attraction prevailed, the comet began to move inward again, at first slowly, but with ever-increasing speed, returning at last to perihelion, and completing this cycle over and over again.

A hyperbolic orbit appears when the comet's velocity is so great that the Sun's attraction is not able to slow it down completely. As it recedes from the Sun, its velocity grows less and less, but always remains greater than a certain limit, so that, after the comet has got a long way from the Sun, its path will be practically a straight line, along which it moves at a definite speed out into interstellar space. Following it back, it is found that (if no forces other than the Sun's attraction had come into play) a comet must have been approaching our system from the outside with this same definite speed, before it was sensibly influenced by the Sun's attraction.

The parabolic orbit reaches the limiting case between the other two, in which the velocity is just too great for the Sun's attraction ever to overcome. A comet moving in an orbit of this kind would forever recede from the Sun, but at a rate continually diminishing, without limit, so that at very great distances its motion would be exceedingly slow.

The slightest retardation of the motion of such a comet would enable the Sun's attraction to gain the upper hand; the orbit would become an elongated ellipse, and the comet would return in due time to the Sun again and again. The slightest acceleration of the comet's motion would convert its orbit into a hyperbola, and send it off to infinity faster than in its original path.

Such effects may arise—indeed, they invariably must arise—from the attractions of the planets upon the comet and the Sun. Repeated slowings of its motion by such encounters may convert a comet's orbit into a relatively small ellipse, around which it goes in a comparatively short period. A slight quickening of its speed may suffice to send it out of our system for good and all.

A comet entering our system from interstellar space, and moving as fast when remote from the Sun as the stars do, would have an orbit of very marked hyperbolic character, which could not possibly be mistaken for a parabola. Not one of the hundreds of comets which have been observed has behaved in this way. Their orbits are sometimes ellipses of relatively short period; much more often they are so nearly parabolic that it takes long and careful observation and extensive calculation to detect any divergence from this form. When this work is done, the deviation is usually found to be in the direction of the ellipse; but in a few cases the orbits are distinctly hyperbolic—differing more from the parabola than any possible errors of observation could account for. Even in these cases, however, the divergence is so small that it would be quite imperceptible in a scale drawing the size of this page showing the part of the comet's orbit which it traversed while under observation. It would seem then, at first sight, that the comets cannot be visitors from outer space, since none of them have orbits of the kind that might then be expected. But Schiaparelli, in 1910, showed that this reasoning was insufficient. A comet visiting us from without would usually pass away, never to return. But if it came near a planet, and its motion was sufficiently retarded, its orbit would become an ellipse, and it would return thereafter again and again, and be counted every time, if our observations were thorough enough and sufficiently long continued. This would be true of every similar "captured" comet; and hence, objects of this sort which, though now members of our system, were not originally so, might form the large majority of the comets actually observed.

If then it can be shown that *any* of the known comets have entered our system from outside, it is possible that *all* of them may have originally done so, some being detained in it, as just described. It is, therefore, very important to know whether the comets, whose orbits when we observed them, near the Sun, were hyperbolic, were moving in hyperbolic orbits as they approached our system, or whether the present character of their orbits has arisen from speeding up of their motion by planetary perturbation.

This is the question which Prof. Strömgren has investigated. Choosing the comets for which the evidence for a hyperbolic orbit was most conclusive, and calculating backward for years, he finds that in every case the hyperbolic character of the observed orbit was actually due to planetary influences. When approaching the Sun, and still remote from it, four of the eight comets investigated were moving in definitely elliptical orbits. In the case of the other four, the original orbit was so nearly parabolic that even the numerous and accurate observations which were obtained did not suffice to show in which direction it differed from a parabola.

In every case the observations are consistent with the belief that the orbit was elliptic; that is, that the comet was returning after a previous visit to the Sun, and was not a visitor from outer space. And in most cases there can be no doubt that this was the fact.

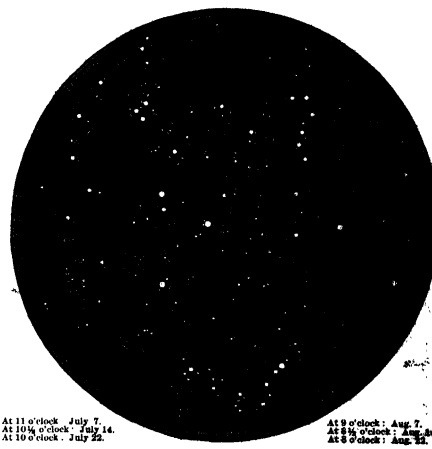
It appears, therefore, to be practically certain that all the known comets have originated within our own system. They belong to the Sun's family, and are not visitors from the stars.

They must be by far the most numerous of the Sun's family, too. Of the eight comets studied by Strömgren, six must have taken at least a million years apiece to complete the round of their orbits preceding the last return, and receded from the Sun while on their way to at least 20,000 times the Earth's distance, or 1/14th of the distance of the nearest star. All these comets appeared within twenty years (from 1890 to 1910). If as many comets of this sort come every twenty years, at least 300,000 of them must come to perihelion before the first ones return—and this takes no account of those which came back, but escaped our notice, during the twenty years aforesaid. The whole number of comets must then be counted by millions, at least.

Of the comets recently or still under observation, Kritzinger's and Zlatinsky's are receding from the Sun and growing fainter. The latter, conspicuous at the time of discovery, will be some thirty times fainter on July 1st than it was then, and not easily visible in a small telescope. Its position on July 3rd will be in right ascension 9 hours 37 minutes, declination 15 degrees south, and it will be moving southeastward about 1 degree per day.

Delavan's comet, on the other hand, is coming out into the morning sky, and rapidly growing brighter. On July 4th it is in 4 hours 57 minutes right ascension + 30 degrees 22 minutes declination, and on the 28th in 6 hours 58 minutes + 37 degrees 39 minutes, close to θ Aurigæ. By this time it is well observable in the morning sky, rising about 1 A. M., and at a good altitude before dawn. It doubles in brightness during the month, but will increase still more in August.

Its orbit must be very nearly parabolic, so nearly so that it will take long calculations to determine its period, if it turns out to be periodic at all.



At 11 o'clock July 7.
At 10¼ o'clock July 14.
At 10 o'clock July 22.

At 9 o'clock: Aug. 7.
At 8½ o'clock: Aug. 14.
At 8 o'clock: Aug. 22.

At 9½ o'clock. July 30.

NIGHT SKY: JULY AND AUGUST

The Heavens.

The familiar constellations of summer need little more in the way of description than our map affords. The great region of the Milky Way—full of bright patches, and abounding in star-clusters and nebulæ—is displayed at its best in the southern sky. Scorpio and Sagittarius, both fine constellations, add to its splendor.

Aquila, Cygnus, and Lyra form a fine group high up in the east and overhead. Hercules and Ophiuchus occupy the southwestern sky, and Bootes is lower, in the west. Above Virgo, which is setting, Ursa Major, Ursa Minor, and Draco are in the north and northwest, and Cassiopeia in the northeast. The great square of Pegasus has just risen, and the dull constellations Aquarius and Capricornus are in the southeast.

The Planets.

Mercury is an evening star at the beginning of the month, but is south of the Sun, and not easy to see, as he sets at 8:30 P. M. He rapidly approaches the Sun, and passes south of it on the 19th, becoming a morning star. At the end of July he rises at 3:40 A. M., and may be seen in the dawn. Venus is conspicuous as an evening star, setting at 9:35 on the 1st and 9 on the 31st. Mars is evening star, too, in Leo, setting at 9:50 on the 15th. Jupiter is in the eastern part of Capricornus, rising at 9:50 on the 1st, and 7:55 on the 31st. He is still pretty far south, but not so much so as for the past three years.

Saturn is a morning star in Taurus, and rises a little before 2 A. M. in the middle of the month.

Uranus is in Capricornus, and is approaching opposition. He crosses the meridian at 1 A. M. on the 20th and is observable much earlier; but he is not near any conspicuous star, and is hard to find. With a star map, he may be picked up, his position being 20 hours, 54 minutes, 5 seconds, — 18 degrees 9 minutes on June 20th, and 20 hours, 49 minutes, 56 seconds, — 18 degrees 18 minutes on July 20th. He is just visible to the naked eye on a clear, dark night, as a star of magnitude 6.0, but is better seen with a field glass.

Neptune is in conjunction with the Sun on the 24th, and is quite invisible.

The Moon is full at 9 A. M. on the 7th, in last quarter at 3 A. M. on the 15th, new at 10 P. M. on the 22nd, and in her first quarter at 7 P. M. on the 29th. She is nearest the Earth on the 3rd and the 30th, and farthest on the 15th. As this last date is near the time of the last quarter, the tides on that day will be an exceptionally small range.

The Moon is in conjunction with Uranus on the 5th, Jupiter on the 10th, Saturn on the 13th, Mercury and Neptune on the 22nd, and with Venus and Mars on the 26th, when the three bodies will form a pretty group.

Princeton University Observatory.

[illegible]

[illegible] Panama Canal [illegible] was marked by the [illegible] "Alliance," a vessel belonging to the Panama Railroad Company. This ship is 300 feet long, 42 feet in beam, and draws about 22.9 feet of water. She displaces 8,905 tons; and when she passed through the canal she had on board 1,800 tons of cargo. The ship was sent through by order of Col. Goethals, for the purpose of making a test with a ship of ocean-going size.

The "Alliance" is shown in our photograph under tow in Gatun locks by the electrical-towing locomotives, one of which is clearly shown in the foreground of the illustration. This locomotive is about to climb the steep incline, 28 1/3 feet in height, by which the tracks rise from one level to the next.

This first transit of the locks by a ship of size occurred on June 8th, and we enter below the full log of the "Alliance" covering the passage from ocean to ocean.

LOG OF THE PASSAGE OF THE PANAMA CANAL BY THE "ALLIANCE."

A. M.	
6:08	Entered Atlantic approach to canal.
6:36	Entered lower level of Gatun locks.
7:15	Started into lower lock chamber.
7:28	Ship in place in lower lock chamber.
7:39	Gates of lower lock chamber closed.
7:39	Started to fill lower lock chamber.
7:46	Lower lock chamber filled.
7:46	Gates to middle lock opened.
7:47	Ship started into middle lock chamber.
7:55	Ship in place in middle lock chamber.
7:57	Gates to middle lock chamber closed
8:00	Started to fill upper lock chamber.
8:11	Upper lock chamber full.
8:12	Gates to upper lock chamber opened.
8:28	Ship in place in upper lock chamber
8:25	Gates to upper lock chamber closed.
8:39	Upper lock chamber full and gates to Gatun Lake opened.
8:42	Ship towed out of upper lock chamber.
8:48	Ship cast off by towing engines and proceeded under own steam.

Making Motorcar Bodies With a Trowel

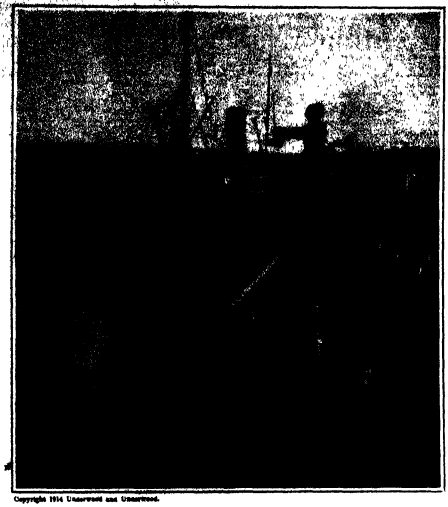
IN a recent article on automobile manufacture we called attention to the variety of trades that contribute to the construction of a modern motorcar. A new class of artisan has just been added to the list. A French firm of car manufacturers makes its car bodies by a novel process of plastering, or may be we should say modeling; for it requires more skill than that of the common plasterer.

Builders are familiar with the process of making partition walls by erecting a screen of wire netting and coating it with a layer of plaster. Practically the same thing is done in the new process of making car bodies, except that a very different plaster is used. The framework of the car is made of wood, and on this wire netting is tacked, as shown in our cover illustration. Then the modeler begins operations with palette and trowel, daubing the wire netting with the plastic material, which he spreads out smoothly. After the coating has set, it may be dressed down with a plane and sandpaper, just like wood. After that it is painted and rubbed down with oils and varnish until it assumes a very high polish.

It is claimed for the new process, that the car bodies can be manufactured with a great saving of time and also, that a very light and durable body is obtained.

Mount Lassen an Active Volcano in California

THE radiant and long dormant volcano known as Lassen Peak, in Shasta County, northern California, burst into eruption on the afternoon of May 30th, since which time several outbreaks of activity have occurred. This mountain is the outstanding summit in a belt of volcanic cones, apparently from the name to be called Lassen Buttes, which begins a few miles to the northward of Mount Shasta and extends southward for about 40 miles. The [illegible] Peak [illegible]



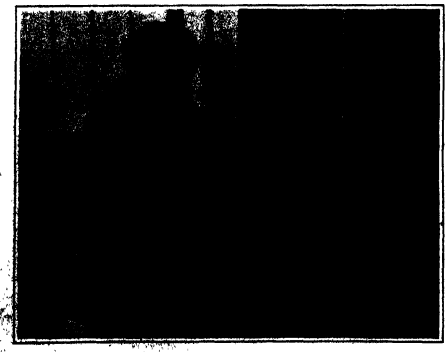
Copyright 1914 Underwood and Underwood.

The "Alliance" passing through Gatun locks.

This steamer, of 8,905 tons, was the first ocean-going ship to pass through the Panama Canal



The modeler applying the plaster to the wire netting.



Smoothing the car body with a plane before applying the paint and varnish.

summit known as the Cinder Cone, which is supposed to have been active as late as the middle of the nineteenth century, though its principal eruption must have occurred at least 200 years ago. Although vast lava sheets and lofty volcanic mountains abound in northern California, Oregon, and Washington, very few eruptions have occurred in this region since the advent of the white man; in fact, such as are supposed to have occurred in historic times belong to the earliest period of settlement, and their dates have been a subject of much controversy. Mount Hood and Mount Rainier still exhale vapor, Mount St. Helens was in eruption in 1841 and 1842; while Mount Baker, the most northerly volcano of the Cascade Range, is said to have been active in 1843. The eruptions above mentioned are the latest that have occurred anywhere in the continental United States (exclusive of Alaska). Hence the interest which attaches to the present outbreak in California.

However, in a comparatively recent period, geologically speaking, the Lassen Peak region was the scene of volcanic eruptions on a tremendous scale. The immediate surroundings of the peak constitute a volcanic ridge about 25 miles in width and 50 miles in length, built up of lava from about 120 vents. Some of the craters are over a mile in diameter. Lassen Peak is connected by lava with Mount Shasta, and, in fact, belongs to a lava-covered area about 200,000 square miles in extent—perhaps the largest volcanic field in the world—extending eastward from the Cascade Range.

The principal geological investigations in the neighborhood of Lassen Peak were those made nearly a quarter of a century ago by Mr. J. S. Diller, who has just been sent by the U. S. Geological Survey to study the recent eruption. Writing in 1894, Mr. Diller said: "That volcanic activity is not yet extinct in the Lassen Peak district is shown by the presence of numerous solfataras and hot springs. At Bumpass's Hell, near the southern base of the peak, there are boiling mud pools and vigorous solfataric action. Near-by, at the head of Mill Creek, the sulphur deposited by such action is so abundant that attempts have been made to mine it. Similar phenomena occur in Hot Spring Valley and at Lake Tartarus and the geyser near Willow Lake. The geyser is much less vigorous than formerly, and now the column of water rises scarcely a foot above its pool."

The first outbreak in the recent eruption opened a new crater on the north flank of the peak, and showered the whole mountain with rock and ashes. A forest ranger who ascended the mountain, May 31st, reported the crater to be 30 feet wide by 50 feet long, with many fissures in the mountain side. No lava was seen. A more violent outbreak occurred on June 9th, and appears to have enlarged the crater to many times its original size. On the 14th and 15th five more outbreaks occurred. One of these is described as having sent a column of black smoke, steam, and ashes to a height of 2,000 feet above the summit. The eruption was conspicuously visible at a distance of 50 miles.

The region surrounding the peak is very sparsely settled, so that very little damage to property has been caused by the eruption, but one man who imprudently attempted to ascend the mountain during the outbreak was mortally injured by a falling rock, and several other persons had narrow escapes.

Decision of Commissioner Ewing.—In the case of Manson v. Hutchison, Commissioner Ewing has overruled the case of Baltzley v. Seeberger and holds that a patentee should not be permitted to bring a motion to dissolve an interference in which he is involved on the ground that it is not patentable, since otherwise the patentee could contend in the Patent Office that the subject matter of the patent is not patentable and in the courts that his patent is valid.

Inventions New and Interesting

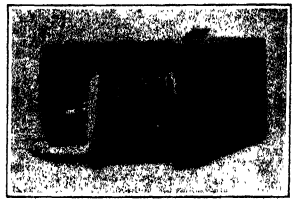
Simple Patent Law; Patent Office News: Notes on Trademarks

Self-inflating Pneumatic Life-preserver

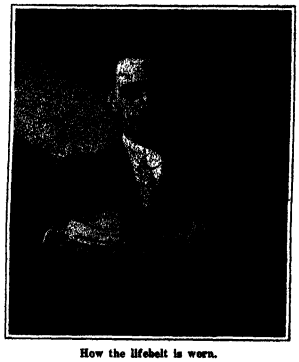
A LIFE-PRESERVER in "vest-pocket" edition has recently appeared on the market. It weighs but 15 ounces, and is carried in a case measuring less than six inches cubed, that looks like a small hand camera. The life-preserver or belt consists of a bag of waterproof canvas, curved to take the form of a ring when extended, and fitted with hollow aluminium ribs. The ribs give the bag the form of a horseshoe, in section; that is, the outer periphery is curved, while the inner one is flat, so that it will have a good bearing on the body of the wearer

The belt is provided with straps at each end, for tying it at both its inner and its outer peripheries.

In applying the life-preserver, inflation is effected automatically by extending the belt, when the air rushes in through a valve. The belt is placed about the body, and first the inner straps are pulled taut and tied, after which the belt is completely distended and inflated by drawing up the outer straps and tying them fast. This done, the valve is closed, and the life-preserver is ready for use Its buoyancy is sufficient to hold a man head and shoulders out of the water. In fact, it will sustain a number of persons. To fold the belt, the valve must first be opened to let the air out. One of our illustrations shows how compactly the belt may be folded.



The lifebelt folded and ready to be packed in its case.



How the lifebelt is worn.

The "Air Towel"

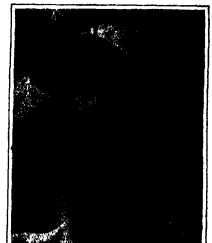
AGITATION for the suppression of the roller or common towel for public use has swept over the entire country, as it is considered a menace to public health. Shortly after the elimination of the public drinking cup by all authorities, the crusade on the common towel in public places started, and some ten months ago Massachusetts, Ohio, and Michigan passed laws prohibiting its use; since then more than thirty States have made similar laws

The common towel was succeeded by the paper towel, the use of which requires, besides the initial expense of the towels, an attendant to supply fresh and remove soiled and wet towels from the lavatories; now the last word in economical and sanitary innovations is the "air towel" used in the large public lavatory in the District Building at Washington, D. C. This "air towel," or electric hand drier, is the invention of J. M. Ward, superintendent of the District Building. In appearance it resembles a rectangular box 11 by 13 inches set on a sanitary base having 12-inch legs, with an opening in the top of the case in which the wet hands are held while being dried. The device consists of a blower that forces air through an electric heating element to ducts and deflectors suitably placed for distributing the warmed air to all parts of the hands at the same time, and is operated by a foot lever or pedal, which in turn operates a quick-acting switch, thereby setting the blower in motion; by removing the foot the device is put out of operation; the hands come in contact with no part of the device, thus assuring a perfectly sanitary operation

It takes just 30 seconds to dry the hands, and although this seems long while standing with the hands in the drier and practically unoccupied, tests have shown that the ordinary operation of drying the hands with a towel consumes more time if the hands are to be dried as thoroughly as by the electrical drier Being dried perfectly, there is no unpleasant sensation.

Sun Glasses for Ball Players

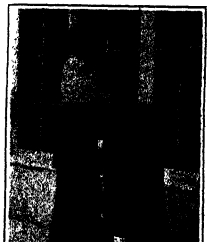
THE latest in baseball is the invention of sun glasses for fielders. The glasses are riveted to the peak of the cap and work on a hinge. When not needed to shield the eyes, the glasses rest against the peak of the cap. When a ball is hit, the fielder wearing a pair of these new glasses simply touches the rim of the glasses, and they fall down in front of his eyes and give him a chance to see the approaching ball while looking directly into the sun. There is no chance for them to fall off the cap, and the fielder does not have to look through dark glasses all the time. They are the invention of Fred Clarke, manager of the Pittsburgh National League team.



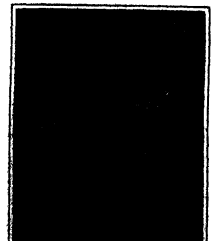
Sun glasses for ball players.

Making the Punch Press Safe

THE punch press has always been a constant source of danger to hands and fingers of the men operating them. Through the invention of the suction lift, all necessity for the operator of a machine to place his hands in the danger zone has been eliminated. The safety device comprises merely a rubber disk attached to a hollow handle which is connected by a hose to a suction line, causing the rubber at the end to act as a "sucker." The device shown is adapted for hand operation only. There is another design that is connected to the back of the machine, and which is free to move back and forth upon an irregularly-shaped rod. Just how far it may move is controlled by the operator on the other side of the press. Here are found two guide arms, one on each side of the press. The workman pushes these arms through under the press and forward the pile of material which he wishes to feed through. As the sucker comes into contact with the first strip of material a lever is pressed by the operator, which opens a suction valve, and the lifter grasps the material and pulls it through.



Drying the hands with air.



Suction lifter for punch presses.

Notes for Inventors

Specialized Invention.—Inventions designed for use in connection with devices or apparatus which have gone largely into general use frequently yield a large reward. The magazines now contain advertisements of appliances especially designed for use on certain well-known machines and restricted as to use on such machines. Consider, for instance, the field that would open to a device that would noticeably increase the efficiency or add to the desirability or comfort of a cheap automobile or safety razor. The market has already been created, and the possessors of the machine or device would have to be convinced only of the merit of the attachment. The improvement should be capable of easy application by the purchaser, and its importance and practicability should be easy of demonstration.

Milk Bottle Tops.—The ideal milk bottle top has probably not yet been invented. The bottle in general use has within the neck a groove in which seats the edge of a card-board disk forced down into place; frequently there is no means to aid in its removal. The groove forms a receptacle for dirt and germs, and the interior of the neck above the groove is a catch-all for dust and other undesirables. If the closure were to fit over instead of in the neck, the groove could be dispensed with, the capacity of the bottle increased, and the entire interior of the bottle neck protected. The problem seems to be in securing a cap cover instead of a disk in the neck. Who can suggest or develop a simple, economical, and practical closure? Wouldn't the consumers be willing to pay for the extra service, or shouldn't the increased business resulting from a better service warrant the additional expenditure on the part of the milkman?

Summer Activities in the Patent Office.—For several years past it has been the custom in the Patent Office to docket few, if any, appeal cases for hearing by the Commissioner of Patents or the Assistant Commissioners during July and August. This year, however, the docketing of cases has continued without regard to the summer months, but doubtless no great difficulty will be experienced in having cases set for hearing during the heated term, postponed on request. In this way the Office will not delay business which ought to be expedited, and the wishes of counsel relatively to summer vacations will have due consideration.

A High-power Explosive.—R. E. Mansfield, Consul General at Vancouver, Canada, tells of tests recently made before business men of Vancouver, of an explosive called "Sabalite," which it is proposed to manufacture at Coquitlam, British Columbia. It is claimed that while the explosive, used for blasting purposes, only requires about one third as much as dynamite, that it can be handled both while in the course of manufacture and in use without danger, that none of its ingredients in themselves are explosive, and that the product is not affected by heat or cold.

Oil Heater for Heating Water.—The General Gas Appliance Company of New York city, as assignee of Charles D. Elmer of Passaic, N. J., has secured a patent 1,095,373, for a water heater in which a number of oil burners, each having an individual chimney, are utilized.

[illegible] Advertising Department of the SCIENTIFIC AMERICAN.

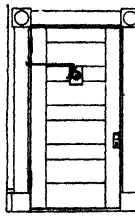
Corrections to appear.

COLLAR FASTENER AND SUPPORT.—MARY E. LEVEN, 172 Manhattan St., New York. The object of this invention is to provide a stiffening support for the standing collars of ladies' garments formed with hooked members or pieces designed to engage the opposite sides of the collar, and thus hold their adjacent ends together and have the collar properly supported.

BELTING AND PROCESS FOR MAKING SAME.—S. PARKER, care of Parker Stearns & Co., 300 Sheffield Ave., Brooklyn, N. Y. The invention relates particularly to an inner belt to be worn by women for the purpose of holding down the shirtwaist and supporting the skirt. The belting has its opposite faces covered with rubber, which in the process of making the belting is given a roughened surface so as to provide a tenacious grip on the shirtwaist and skirt.

Electrical Devices.

PORTABLE BURGLAR ALARM.—S. SUNDEN, 106 E. 126th St., New York. A burglar alarm is provided by this invention for the use of travelers and other persons. It may be conveniently attached to a door, window or other movable part with a view to sounding



PORTABLE BURGLAR ALARM FOR TRAVELERS.

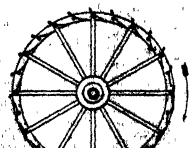
an alarm on the movement of that part A flexible connection runs from an electric contact device to a fixed part such as a door frame, so that when the door is opened, the contact is closed and the alarm is sounded.

Of Interest to Farmers.

SILO.—C. HUNGERFORD, Soldier, Kan As the usual hoop and stave construction of silos is liable to distortion under strains of swelling and shrinking, the present invention provides a construction embodying a novel arrangement of uprights and horizontal beams, whereby the necessary strength will be given the structure as it progresses, and the element entering into the construction will be so disposed as to provide a convenient and effective support for planks without the necessity of erecting scaffolding.

PLANT-SPACING MACHINE.—J. A. LOVE, Box 214, Red Springs, North Carolina. The present invention relates generally to machines for spacing plants by cropping out the intervening plants, the object being to provide a simple arrangement of parts embodying a readily controllable friction drive for the chopping hoe, and a chopping hoe pivoted in the frame of the machine to oscillate laterally thereof, which may be readily adjusted and raised in an inoperative position when desired.

TRACTION WHEEL.—E. C. SHINDLER, Dalhart, Texas. This traction wheel is provided with improved tractor members or plates mounted between annular rim plates of the wheel and arranged to form the tractive surface of the wheel when passing over a hard



TRACTION WHEEL THAT WILL NOT SLIP ON SOFT GROUND.

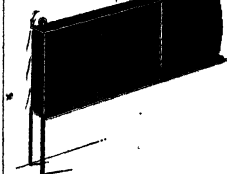
ground, whereby the latter automatically prevents the tractor members in contact with soft earth from engaging the ground and thereby destroying grip and prevent the wheel from slipping.

COMBINED SEED PLANTER AND FERTILIZER DISTRIBUTOR.—T. C. WILSON, care of Holman & Holman, Fayetteville, Tenn. This device may be readily attached to a plow of any standard construction, and will uniformly distribute the fertilizer on the plowed ground, automatically feed the seed into a progressively formed seed furrow and cover the seed so deposited. Thus all the work of planting and fertilizing is done in the one operation of plowing the ground.

Of General Interest.

PLASTER COMPOSITION.—J. E. FAIRFAX, Aiken, South Carolina. This plaster composition is waterproof and can be used on wood as well as metal laths. It comprises ingredients substantially in proportion as follows: Plaster of Paris, 25 per cent; slaked lime, 25 per cent; kaolin, 5 per cent; sand, 44.65 per cent; fibered hay, 5 per cent; Rochelle salt, .05 per cent.

BLACKBOARD.—EMILY K. HOPKINS, 609 E. Chestnut St., Louisville, Ky. This blackboard is provided with movable sections designed to be nested one in front of the other whenever desired. The framework of the blackboard is provided with a lower guiding portion



BLACKBOARD WITH MOVABLE SECTIONS.

and a number of upper rails, each adapted to receive collars, which hold suspended, various blackboard sections. By this means any of the sections may be moved back and forth along the rails.

BELT LOOP.—H. F. NILES, 1257 N. Clark St., Chicago, Ill. The present invention relates to belt loops used in garment supporting of the type shown in patent, No. 1,039,895, previously granted to Mr. Niles. The object of the present invention is to reduce the cost of the manufacture of loops of this character and to construct a loop from material of light weight, to avoid bulkiness in appearance.

BED JOINT.—A. POLANSKY, 653 Boulevard, Bayonne, N. J. One member of the joint consists of a metal band secured to the bed post and arranged to form a tapered socket. The other member of the joint consists of a plate adapted to fit into this socket, and connected to a bed rail with a spacing member interposed.

SPOOL MAGAZINE.—E. PRINCE, 747 Madison Ave., New York. A simple form of magazine is here provided for spools which may be easily and quickly secured to any suitable place such as a work table and wherein spools can be added or removed indicating readily by the color of the thread on the spools can be seen at a glance. By the use of this device, the tangling of the thread on the spools is avoided.

SEWING OUTFIT.—L. KALINA, 132 Nassau St., New York. In order to furnish a compact sewing outfit for pocket use, this invention provides a shell, which is closed at one end by a thimble, and at the other by a pin cushion, while within the shell are a needle case and a series of spools of sewing thread.

Hardware and Tools.

NUT LOCK.—J. J. GILCHRIST, 122 Anderson Street, N. S., Pittsburgh, Pa. The device consists of a washer having a resilient member to engage the side of a nut, and a locking plate with a bolt hole, a side flange to engage a side of the nut, and a resilient forked flange at an acute angle to the plate at the under side thereof, to straddle the bolt, the fork presenting two inner edges to engage a bolt thread, there being co-acting locking elements on the washer and lock plates to engage each other.

Heating and Lighting.

FURNACE.—F. H. WRIGHT, 114 E. 4th St., Chattanooga, Tenn. The invention relates to furnaces for general use and more especially to coal burning furnaces in which the grate bars are apt to become very hot, and in which as a consequence it is desirable to cool the grate bars by passing air through them, and causing the air thus heated to assist the combustion of the fuel. The invention also provides means for handling the fuel during its passage through the furnace, and distributing the air supply into and through the fuel.

Household Appliances.

WASHTUB.—A. L. BLUM, 179 W. 73rd St., New York. Among the principal objects which the present invention has in view are to provide a tub with a rubbing section or board portion formed integrally therein; to provide a relatively light and strong rubbing section; and to simplify and reduce the cost of construction.

Machines and Mechanical Devices.

MULTIPLE SIGNATURE MACHINE.—W. F. WILLIAMS, P. O Box 100, Miami, Arizona. Among the objects of this invention is to provide a multiple signature machine characterized by the ease of manipulation and reliability of operation, due to the simplicity of construction and lightness of all movable joints Another object is to provide means whereby additional pens may be utilized, or the number of pens reduced, with the minimum amount of trouble or loss of time, thereby adapting the machine for a wide range of uses

WATER LIFTING DEVICE.—L. G ROSE, P. O Lock Box 126, Parma, Idaho An improvement in water-lifting devices is here provided, consisting of a simple, inexpensive, and portable device especially adapted for use in irrigating ditches, for lifting the water from the ditch to the ground to be irrigated, when the ground is at a higher level than the ditch The device may easily be transported from place to place, and in its construction, valves of all characters are dispensed with

ATTACHMENT FOR CONVEYERS FOR BOTTLED SODA WATER.—E. R BARBER, Valdosta, Lowndes County, Georgia. The present application is a division of an application filed previously by Mr. Barber, and relates particularly to a deflector attachment arranged in connection with a table forming part of the apparatus. The table has such capacity that any temporary suspension in the work of the attendants removing the bottles from the table while the conveyer continues to operate and deliver bottles, will simply serve to collect the bottles on the table, first at the outside, then gradually adding to the collected bottles until the table is filled.

JACK-SPOOL AND FASTENER.—H. O. TAFT, care Vermont Spool and Bobbin Co., Burlington, Vermont. This invention has for its object to provide an improved structure in jack-spools and fasteners that will not become loose, so that the head and gudgeon cannot grind against the cylinder Another object of the invention is to provide a gudgeon and a lock for preventing the rotation thereof, whereby the head is held rigidly connected with the cylinder of the spool and none of the parts is allowed independent movement.

Medical Appliances.

FOUNTAIN SYRINGE ATTACHMENT.—H F. ORG, 304 Oregonian Bldg., Portland, Oregon The invention consists of a nozzle comprising a tubular globular member having a smooth inner end and an outer end comprising a valve piece, these ends having openings in alignment with each other. The device is also provided with an inlet neck on one side not far removed from the outside opening.

Prime Movers and Their Accessories.

BOILER ATTACHMENT.—J S DEVLIN, 141 N Seventh St., Brooklyn, N Y. This attachment for water-tube boilers is arranged to retard the travel of the ashes and gases from the boiler into the draft flue, to insure complete combustion of the burning fuel without interfering with the natural ass of the boiler In order to do this, use is made of a casing arranged within the combustion chamber of the boiler at the entrance of the draft flue, a skeleton support held in the casing and carrying a set of bell-shaped retarding members and a grid movable toward and from the said retarding members and having openings in registor with them.

CARBURETTER.—F. L. TATOM, Hosford, Florida The carburetter consists of a dome forming a spray chamber, which is mounted upon a float chamber. Leading up from the gasoline in the float chamber is a group of tubes, communicating at their lower ends with a hollow head, while their upper ends lie adjacent to the upper ends of a series of tubes through which compressed air is forced. These spraying devices being entirely inclosed within the structure of the carburetter are not liable to become clogged through the formation of ice due to the presence of moisture in the air

Railways and Their Accessories.

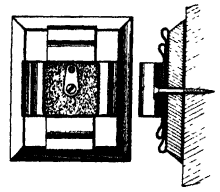
MACHINE FOR EXTERMINATING WEEDS. A. MILLER, Kiester, Minn. The invention is an improvement on a machine for exterminating weeds and has for its object to provide an apparatus especially adapted for use on rail-



MACHINE FOR EXTERMINATING WEEDS.

roads. It is so arranged that it may propel itself along the railroad, and is fitted with mechanism which during its motion will uproot and remove the weeds growing between the rails.

ARTICLE HOLDER.—W. M. GLOSSBRLT, Ohioppyle, Pa. This article holder is especially adapted for use in railway cars, for holding small articles such as tickets, hats, caps, and the like within easy reach of the traveler.



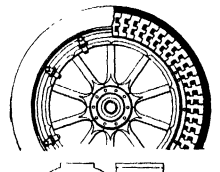
ARTICLE HOLDER FOR RAILWAY CARS.

It consists of a block upon which are mounted two springs, each bent and folded to form superposed loops, so that articles may be clasped between these loops The two springs are arranged at right angles to each other, as shown in the illustration

Vehicles and Their Accessories.

HYDRAULIC POWER TRANSMISSION SYSTEM FOR WHEELED VEHICLES.—R S WILLIAMS, 17 Arcade, care Ben S Williams Safe and Lock Co., Nashville, Tenn The object of this invention is to enable the operator to use a number of separate driving units or pumps connected with driven units, and by throwing the driving units into action one at a time, to carry the pressure and volume of the liquid as admitted to the driven unit An other object is to enable the operator to reverse the direction and travel of the liquid, the reversal taking place in all the units which happen to be in action at the time, to eliminate the necessity for differential gears, transmission gears, etc., and to improve various parts in connection with systems of this kind.

VEHICLE TIRE.—CHRISTIAN SPECHT, 417 Ocean View Ave., Woodhaven, L. I., N Y This invention relates to vehicle tires, and has for its object certain new and novel features adapted to produce a resilient tire, which is not liable to become worthless from punctures



IMPROVED VEHICLE TIRE

or other injuries, and comprises the usual outer tire, or shoe, inclosing interlocking blocks of rubber or similar material, the shoe being clamped in place by rings secured to the rim of the wheel

Designs.

DESIGN FOR A CROCHET-COTTON HOLDER.—W W. MCCHESNEY, care of V Sales Company, 12 Spruce St., New York

DESIGN FOR A CARPET OR RUG.—J. T. PRIMIS, care of G S Squire, 25 Madison Ave., New York

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NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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NEW BOOKS, ETC.

THE YACHTSMAN'S ANNUAL GUIDE AND NAUTICAL CALENDAR. Thirty-sixth year. Boston: Clarence B. Hogg, 1914. 8vo.; 394 pp. Price, $1.

Some years ago we commented unfavorably upon this book, and gave instances where the information was wofully obsolete. There is, however, no criticism of this nature to be made of the present volume. This is an admirable guide for the use of the yachtsman, and is also a valuable fund of information to those who take only a fireside or book interest in yachting. It is filled with most valuable information, tables, maps and charts. It is sure to be well received, especially at a time when the eyes of the whole world are centered upon the "America" Cup races. The same publisher is bringing out, in a short time, a separate Cup Race publication which will contain among other useful matter some valuable information taken from the SCIENTIFIC AMERICAN, and published by special arrangement.

THE LAW OF PATENTS. By Walter F. Rogers, of the District of Columbia and New York Bars. In Two Volumes. The Bobbs-Merrill Company, 1914. 1859 pp. Price, $15 net.

In the two volumes constituting this work, the author has, it seems to us, placed at the disposal of those interested in patents a very able statement of the history of the legislation on the subject and of the rights and liabilities arising from the grant of patents. The rights of the inventor, and the applicant for the grant of a patent before the grant, the practice in interference proceedings in the Patent Office, and in appeals is clearly set forth so that the layman as well as the lawyer can understand it and be interested, and though brief, the matters seem to have been thoroughly covered. The work for the most part consists of extracts from decided cases illustrating points of practice in the courts pertaining to such matters as jurisdiction, pleading, suits at law and in equity, etc., also invention and infringement, and a very able analysis of the New Equity Rules, all of which should prove of inestimable value to the busy lawyer. The cases which have been selected by the author are leading cases, and the full and free abstracts provided are clearly explanatory of the science of the law as relating to patents.

PHYSIKALISCHE CHEMIE DER HOMOGENEN UND HETEROGENEN GASREAKTIONEN, MIT BESONDERER RUCKSICHT DER STRAHLUNGS UND QUANTENLEHRE SOWIE DES NERNSTSCHEN THEOREMS. (Physical Chemistry of Homogeneous and Heterogeneous Gas Reactions, with Special Regard to the Theory of Radiation and of Energy-Quanta, and the Nernst Theorem.) By Karl Jellinek. Leipzig: S. Hirzel, 1913. 844 pp. 10 x 7 inches. Price, in paper cover, 30 marks; bound, 32.5.0 marks.

If evidence is needed of the immense advances which have been made of recent years in our knowledge of the phenomena lying at the very root of chemistry and physics, a glance over the pages of the book before us brings abundant proof. It represents a very comprehensive presentation in text-book, or perhaps rather handbook, form of the vast field of phenomena which to-day are of prime interest to the physical chemist.

The book is divided into four main divisions devoted respectively to the Statics (Thermodynamics), the Kinetics, the Electro-chemistry and the Photo-chemistry of Gas Reactions.

The author begins with a discussion of the foundations of thermodynamics. In developing the second law, he makes use of the common method of considering a cycle carried out with an ideal perfect gas. It seems to us however that this method is unfortunate, for on the one hand it bases the argument on a substance which does not exist, and on the other it is apt to leave in the student's mind the impression that there is some particular virtue in the use of an ideal gas—just the opposite of the impression that should be emphasized, namely, that the nature of the working substance is quite immaterial.

The author then proceeds to discuss the statics of gas reactions, first, on the basis of reversible cycles, and then by the aid of the several characteristic thermodynamic functions, entropy, free energy and thermodynamic potential. In this part of the book we also find the first introduction of the Nernst theorem considered first from the standpoint of thermodynamics, and then from that of statistical mechanics.

The fourth section of the book is devoted to the modern theory of radiation, and introduces Planck's formula derived from the theory of electrical oscillators.

The fifth section deals with the connection between the theory of heat radiation and the theory of specific heats of heat of reaction and the Nernst theorem.

The remainder of the first division (statics) is devoted to a discussion of experimental data.

The divisions on the Kinetics Electro-chemistry and Photo-chemistry of Gas Reactions take up about 190 out of the total of 844 pages of the work.

Dr Jellinek's book stands alone as the most up-to-date and complete repertory of a vast amount of information scattered through current literature, and not elsewhere presented in collected form.

A. J. L.

HARRINGTON EMERSON'S HOME COURSE OF STUDY IN PERSONAL EFFICIENCY. The Emerson Institute, 30 Irving Place, New York.

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JAHRBUCH DES LUFTFAHRZEUG-GESELLSCHAFT. Sechster Band. 1912-1913. Berlin: Verlag von Julius Springer, 1913.

Germany publishes probably more exhaustive technical information on aeronautics than any other country—information which takes the shape, not only of books and periodicals, but of annuals issued by technical and learned societies devoted especially to the furtherance of aeronautics. Of these annuals, one of the most important is the "Jahrbuch der Luftfahrzeug-Gesellschaft." The contributors are men of them who stand in the foremost rank as authorities in their especial fields. Thus we find in the volume which lies before us a splendid contribution by Count Arco on wireless telegraphy in aeronautics, an exceedingly able mathematical analysis of the distribution of strains in the envelopes of non-rigid dirigibles by Karl Heyer, and a very instructive report on the Goettingen aerodynamic laboratory by the distinguished Prof Prandtl himself. In a work such as this one obtains glimpses of the activity of German aeronauts of which one hears but little in the press. The valuable articles before us may be heartily recommended to those who take a technical interest in aeronautics.

MEERES FISCHE. Von Dr. Kurt Floericke. Kosmos Gesellschaft der Naturfreunde, Stuttgart: Franck'sche Verlagshandlung, 1914.

This is a popular, interestingly written book on some common and some unusual forms of fishes. It it an insight not only into the life history of some interesting fishes, but also the industrial uses of fishes.

THE FOUNDATIONS OF NORMAL AND ABNORMAL PSYCHOLOGY. By Boris Sidis, A.M., Ph.D., M.D. Boston: Richard G. Badger. 8vo.; 416 pp.; illustrated. Price, $2.50 net.

Some day, perhaps, H. G. Wells may write an article on the scientific postulate and posterity. Whatever else such an article might be, it would be eminently readable. As Prof. Sidis points out, even such an exact science as mathematics has had its axioms disputed. Psychology is one of our baby sciences, and no doubt its present working theories perhaps rather of the nature of scaffolding than of corner-stones. Yet this scaffolding is indispensable to the erection of a substantial structure. Hence Prof. Sidis very properly devotes much of his space to elucidating the formulated assumptions of psychology. He deplores the existing tendency to confound this study with spiritism, religion, and the faith cure. No one who follows his fascinating pages can long harbor that delusion. In the latter portion of the work such subjects as stimulation, reaction, exhaustion, inhibition, unity, synthesis, and purpose, in all their manifestations and interrelations, are discussed in a masterly manner, and the author's own theory of "moment-consciousness" is exhaustively explained. This theory appraises the quality and follows the development of consciousness, from reflex through complex reflex and instinctive, to its highest form—self-consciousness. In all this journey he is careful not to ignore the biological viewpoint, hence we have a solid foundation instead of what is so apt to degenerate into futile lotterings and wanderings. The normal and the abnormal are made to throw light the one upon the other, a method famous in the trial-balance proof of the accountant, and one that results in an eminently sane and balanced concept. Prof Sidis has worthily extended the observations of the late William James, to whom as an master and friend the present volume is dedicated. He does not, however, fatuously accept all James's conclusions, but indorses his psychological introspection, while rejecting many of his metaphysical complications.

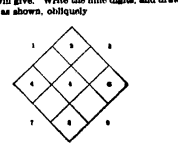
THE A B C AND X Y Z OF BEE CULTURE. A Cyclopedia of Everything Pertaining to the Care of the Honey-Bee; Bees, Hives, Honey, Implements, Honey Plants, etc. By A. I. and E. R. Root. Medina, Ohio: The A. I. Root Company, 1913. 8vo.; 717 pp.; illustrated.

The Roots, father and son, have been so fortunately situated that they have been able to supplement their own wide experience with that of numberless others, and thus to keep fully abreast of the most recent practice and experience. So that the somewhat grandiloquent claim of their title and sub-title seems to be fairly well borne out by the book itself. In this the knowledge of thousands of beekeepers is embodied, and in most cases the theories presented have been verified in their own apiary. Every branch of the industry from production to sales is treated, and the arrangement follows the alphabetical order, so that any required information is instantly accessible.



Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(13007) W. C. P. writes: The Magic Squares which appeared in the SCIENTIFIC AMERICAN a few years ago, came recently to my attention, and I recalled a graphical solution which I once saw for making the simpler forms of these curious arrangements of numbers, those employing the nine digits and also the first sixteen numbers. These I will give. Write the nine digits, and draw a square as shown, obliquely



Now fill the vacant places in the square by the number in the same diagonal line, but at the farther end of the diagonal; thus, 9 and 1 exchange places, and 3 and 7 are similarly moved. The result is shown in the magic square:

4	9	2
3	5	7
8	1	6

This may be easily generalized so that any nine consecutive numbers may be arranged in a magic square as follows. Let n be any number, and write the nine numbers in the same order as given with the figures. You will have the square

$n+3$	$n+8$	$n+1$
$n+2$	$n+4$	$n+6$
$n+7$	n	$n+5$

With this square, any number of squares may be made. Let $n = 0$. The resulting square is given. The sum of the lines and diagonals is 12.

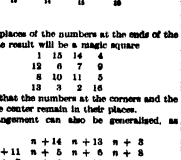
3	8	1
2	4	6
7	0	5

Let $n = 13$, the resulting square is

16	21	14
15	17	19
20	13	18

The sum is 51

A graphical method may also be applied to squares of 16 numbers, as follows. Write the numbers and draw lines across the square as shown. Then



exchange places of the numbers at the ends of the lines. The result will be a magic square

1	15	14	4
12	6	7	9
8	10	11	5
13	3	2	16

It is seen that the numbers at the corners and the four in the center remain in their places.

This arrangement can also be generalised, as follows:

n	$n+14$	$n+13$	$n+3$
$n+11$	$n+5$	$n+6$	$n+8$
$n+7$	$n+9$	$n+10$	$n+4$
$n+12$	$n+2$	$n+1$	$n+15$

Using this square by giving n any value whatever, a magic square will be formed. Perhaps, and probably, the more elaborate squares may be drawn out graphically.

(13008) A. B. C. asks how he can see the spokes of the wheels of a passing motor-car standing still or even turning backward when the light was not rendered intermittent by the pickets of a fence or any other visible means. A. We have always answered this query by saying that the light must be intermittent in order to produce this phenomenon. A paper which appeared in the Proceedings of the Royal Society, which has recently come under our notice, considers this question and applies the test of experiment to it. The statement is made that these appearances are real, last but for a fraction of a second, and coincide with the steps of the observer. The rate of the forward motion of the eye produces the effect. It is only to be seen also when the speed of the vehicle lies between certain limits. The motion of the spokes must be too quick for the eye to follow and must not exceed a certain limit, which is not quite the same for all persons. The matter was tested experimentally by means of a disk of black paper on which white spokes were drawn. When as few as 9 or 10 spokes pass a point in a second, only a flicker results. When 90 or more pass in a second, only a gray surface can be seen. The individual lines are invisible. Between these limits it is possible to produce the effect of intermittent vision.

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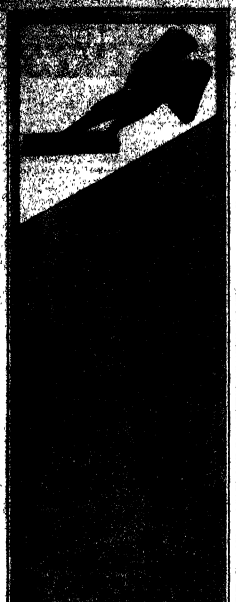
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X-ray in Treatment of Disease

(Concluded from page 4.)

rays. To overcome the second difficulty, the source must be placed at a considerable distance from the subject to be treated, so that differences in the distance of the several parts subjected to the rays become insignificant in comparison with the actual distance.

The Method of Cross-firing.

With all the special measures discussed above, it would not be possible to produce an entirely homogeneous field of Roentgen radiation, extending to deep-lying structures and organs. Still less would it be possible to expose an internal organ to radiation of greater intensity than the overlying surface structures, as may be desirable for the treatment of internal tumors. True, in exceptional cases a specially constructed X-ray tube, or a part of such tube, may be introduced into the body. In some cases, also, the use of radium may be resorted to. But what is to be done in the case where neither of these methods is applicable?

The resources of the physicist are not yet exhausted. If two streams of rays are sent into the body through different entrance areas, that portion of the field where the two streams cross will be exposed to a double radiation, while the skin, for example, receives only a single stream. In this way a diseased part can be given an energetic dose, while for the healthy parts the dose may be kept below the limits at which undesirable effects become felt.

We have here discussed only the methods of application of X-rays. It is not our function to discuss their efficacy as a remedial agent. We must restrict our remarks on this point to the statement that as yet the invisible radiations cannot be looked upon as cures for cancer, although some promising results, especially with myoma and superficial growths, have been obtained by some of the workers in this field. In certain cases, too, where cure would hardly be looked for, at least considerable relief for the patient was secured. The whole field of radiotherapy is still in its infancy. While, for this reason, the value of the results obtained so far, and of those to be expected in the future, is somewhat a matter of dispute, all homage is due to the able and earnest workers who are straining every effort to advance this branch of medical science. In Germany, in particular, very excellent work in the X-ray treatment of tumors has been done by Prof. Bumm of Berlin, and Profs. Krönig and Gauss of Freiburg. Promising results have also been reported by Profs. De la Camp and Küpferle in the treatment of pulmonary phthisis.

We cannot close without a word of warning to prevent any possible misunderstanding. So long as radiotherapy is in its present experimental stage, it must be remembered that in many cases the only safe course is to resort to the knife. A competent surgeon's advice must in all cases be followed, regardless of any sacrifice which it may involve. Hesitation, in such matters, may be paid for at a terrible cost.

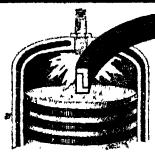
The Manufacture and Fitting of Piston Rings

(Concluded from page 11.)

around so that the joints formed a continuous opening, and as the notch cut out of the joint to accommodate the pin would materially weaken a small ring, some designers employ no pins whatsoever.

Inasmuch as the rings must be compressed, in order that the piston may be inserted in the cylinder, the depth of the ring groove must be equal to the thickness of the ring. As the rings expand to conform to the size of the cylinder bore, a small space is left between their inside circumference and the back of the grooves. Therefore, if the edges of the rings did not fit closely against the sides of the grooves, a space for the escape of the gas would be allowed back of each ring, and consequently the finish and fit of the sides of the ring and groove is another important caution to which much attention is paid by reliable manufacturers.

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There is, naturally, but one position of each ring in which it can form an absolutely perfect circle, and the ring is so designed and cut that these conditions obtain when it is expanded to fit the cylinder walls. Theoretically, a ring should press with equal force against all parts of the cylinder wall, and these conditions can most nearly be obtained if the ring is cut eccentric, with the ends, at the joint, thinner than the center. The usual practice is to make the ends one half of the thickness of the center. However, inasmuch as the ideal condition of equal pressure at all points is impossible to attain, many manufacturers contend that the concentrically formed ring serves the purpose as well, and is stronger at all points than is that of the eccentric shape.

Piston rings are generally cut from long, cast iron cylinders, approximating in both outside and inside diameter the size to which the ring is to be formed. This cylinder is sometimes known as a "pot," and is cut in a special fixture placed in a lathe. The pot is generally of sufficient length to enable twelve or fifteen rings to be cut from it by means of a special tool designed for the purpose. This tool consists of a series of parallel, stationary cutters that are mounted on the tool carriage and fed toward the axis of the pot. There are, of course, as many tools in the series as there are rings to be cut from the pot. Each successive tool of the series is generally arranged at a greater distance from the pot to be worked, so that all do not start cutting at the same time. The edge of each tool is sometimes rounded slightly so that a thin circle of material remains at the inside edge of each ring. This is removed when the rings are ground.

If the rings are to be cut eccentrically, the pot is mounted on a fixture having a pivoted stud. The pivot is at a certain distance from the center of the fixture and stud, and the swinging limit of the latter is regulated by a slot and pin. The stud and pot are moved to the outer extremity of the slot when the outside finishing cut of the cylinder is to be taken, and then swung back to the inside limit when the interior is to be bored. This serves to throw the pot "off center" by a sufficient amount to make the inside diameter eccentric in relation to the outer diameter. If the pot is eccentric, the rings from which it is cut will also, naturally, be eccentric. After being turned and bored, the pots are put away, to season and cool. This relieves the material of the strains that will always be induced in cast iron by any machining operation.

The necessity for making rings of exactly the proper width has resulted in the design of several special types of grinding machines. The grinding and polishing wheel machines to closer accuracy than any other tool, and therefore the half-thousandths inch exactness necessary is entrusted to this. An interesting type of edge grinder consists of a rapidly revolving emery wheel, set on a horizontal axis, and a slower-turning bed, or chuck, placed under the periphery of the wheel, and at right angles to its surface. The ring to be ground is placed on this chuck, and as the periphery of the rapidly revolving emery wheel impinges on the edge of the ring, the latter is ground to the correct size—provided the chuck has been set in the proper position. In order to facilitate the setting of the ring in the chuck and its removal therefrom, the chuck differs from that of the jaw type ordinarily found on a lathe. The ring is held in place by means of the magnetism of an electrically excited core forming the bed of the chuck, and controlled by a switch placed near the operator. When the ring is placed on the bed of the chuck and the current turned on, the work is held rigidly in position. A machine of this type can easily grind 500 rings per day, and at the same time do the work so accurately that but few fail to pass the rigid tests conducted by the inspectors.

The finishing of the outside faces of the rings is done in a more common type of grinding machine. This is similar, in general appearance, to a lathe with the work placed in the ordinary position on an arbor carried between the headstock and

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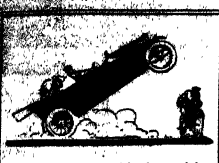
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tailstock. A high-speed emery wheel is driven on a parallel shaft, and the feeds are so arranged that the distances between the two shafts may be changed, or the wheel itself may be moved longitudinally along its axis. The rings to be finished are mounted on a cylinder or mandrel, provided with an adjustable clamp at one end, and when a dozen or so are pressed tightly along each side of each other and the clamp is set, the rings are held rigidly in place. All rings are thus ground to the same diameter, and if they have previously been split, they should be tightly closed when mounted, in order that their outside will be finished to a perfect circle.

The finishing of the inside of the rings is a matter of varying practice. Some manufacturers believe that the small scale left after casting and boring renders the ring more elastic, and therefore do not attempt to remove it. All well-made rings are thoroughly tested by expert inspectors, however, and the width and thickness measured to the half-thousandth of an inch. The ring is further tested for flaws in the metal, and is then examined to determine its elasticity by expanding it sufficiently to slide over a piston of the same size as that for which the ring is intended. If it is discovered that any permanent set has taken place after this operation, the ring is discarded as being insufficiently flexible. Rings are also discarded if, after compression to a perfect circle, they fail to spring back to their normal size.

As a chain can be no stronger than its weakest link, so can the ordinary piston ring be no tighter than its joint. This weakness of the joint of the piston ring has led to the design of several types in which the joint is "backed up" or reinforced by another ring or pair of rings. One of the best known of this class of rings consists of two separate rings of "L" section, of such a size and shape that the projection of the "foot" of one "L" equals the thickness of the "shank" of the other, and the section of the two as they are fitted together becomes a perfect rectangle. Each ring, of course, is split to allow for the proper expansion, and a pin holds each in its correct position with relation to the other, so that the joints must remain opposite each other.

In other types of this "jointless" ring, an outside ring of full width is used, while surrounding this are two rings of half width. Various shapes are employed to hold the three pieces together; one of the simplest of these is to frm the two narrow rings of "L" section with the "feet" adjoining in the center and making a "lip" that exactly fits in the groove provided in the larger inner ring. In other forms, the larger ring is the outside one, while the two rings of half width are placed inside. In all cases, the individual rings are pinned to their neighbors, to prevent any of the openings from falling into line.

It will be noted that rings of this type do not need to be pinned in the piston, as their jointless form eliminates any possibility that the compression of the force of the explosion will "blow through" because of the change in the position of the individual rings.

Neglect of the Human Machine

By Eugene Lyman Fisk, M.D., Director of Hygiene the Life Extension Institute, Inc.

TO speak of the human body as a machine may offend some people's sensibilities, but we must take that risk, conceding, of course, that the analogy should not be carried so far as to include man as a whole, because, notwithstanding all that has been written, from Thales to Bergson, nobody knows what man *is* as a whole.

Many machines are "fool-proof," but it is not so with the human body.

True, there is a certain "factor of safety" that allows for ill treatment of the body, for starvation, for gluttony, for poisoning, for infection, and for various other strains and stresses, just as every well-built machine is planned to withstand more wear and tear than it is called upon to undergo with average use; but this factor of safety is not the same in all individuals. In some, it is a negligible quantity, in others, it is raised to the "nth" power, as in the occasional in-

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stance of an old toper who lives into the eighties well nigh poison-proof, like Mithridates of old.

That most people exceed their factor of safety is shown by the fact that few people die a physiological death, if one may use such a term. The human clock usually *breaks down* instead of "*running down.*" For example, in the United States there were, in 1910, more than 100,000 deaths, between the ages of forty and sixty, from diseases of the heart, circulation and kidneys. Preceding most deaths (not due to accident or to acute disease) there is usually a long period of impairment, or of progressive changes that gradually reduce the value of the individual to himself and to society before the final and total loss.

Is this condition of affairs creditable to human intelligence?

Should we be content with the mere survival of the race? Is it any more reasonable to be satisfied with the average man as he is to-day than it would have been to rest satisfied with the locomotive of the forties?

That man as a practical, every-day, useful citizen, cannot exist by will power or by psychic force alone, but is dependent upon the mechanical integrity of his parts, is shown by a very brief survey of elementary physiological facts.

Consider the circulatory system alone. The heart is a pump that forces the blood through a system of elastic tubing—the arteries. If this tubing is overstrained, it deteriorates and frequently it bursts, causing death by apoplexy, if the affected tube happens to be in the brain.

Now, let us suppose that in every household there was a complex machine operated by a pump, and a system of delicate tubing upon which the life of the family depended. Let us assume that the bursting of that tubing or the breaking down of the valves or of the walls of the pump would bring death into the household—what would be the public and private attitude toward such a machine? Undoubtedly the government would inspect it regularly even if individuals could be found so foolhardy as to neglect such an obvious duty, in line with the so-called first law of nature—self-preservation.

There may be something repellent in the mechanistic truth that the mighty brain of a philosopher or of a statesman is just as dependent upon the potency and integrity of certain elastic tubes as is that of the hound that lies at his feet, but such is the fact, and if the philosopher or statesman wishes to be spared for a reasonable time to carry on his work, he must take care of his tubing.

Of what avail is inspection of the human machine? Can inspection detect changes in the working parts in time for the repair man to make things right? Fortunately the answer is emphatically "YES." Long before the tubing, which we have referred to as so important a part of the human machine, is seriously impaired, the fact of over-strain can be determined and the strain being abated, the life of the tube is prolonged; also the keen inspector can detect the early signs of failure in the pump and said pump can be strengthened and its burdens adjusted to its capacity.

Long before the kidneys—those sponges for absorbing and separating from the blood-current its waste products—are seriously impaired, the microscope and the chemical re-agent can reveal the signs of over-strain. Heart, blood vessels, and kidneys are closely dependent each upon the other and the inspector's tests seldom fail to find a weak spot in this system, if it be present.

Many of these human machines can be adjusted to run perhaps for many years at a lower speed, whereas, a continuance of high speed would mean early and inevitable breakdown. In other cases, the machine is doing the wrong kind of work or it is not being operated with the right kind of fuel.

Are these more scientific day dreams as illusive as the philosopher's stone or the elixir of life? Fortunately for the ready acceptance of these truths, they have been tested in the practical business world as a matter of business economy.

About five years ago, the officers of a life insurance company decided to offer to their policyholders the privilege of a free medical examination once each year for the purpose outlined in this article, namely, inspection of the human machine in order to detect the need for repair. Out of 2,500 people who accepted this service, 40 per cent were found more or less out of order and in need of repairs, most of the derangements being found in the heart, blood vessels and kidneys, as the average age of the group was high, 46. Of those found impaired, 44 per cent *were not aware* of impairment. The insurance company did not, of course, undertake to treat these people, but with their consent reported the impairment to the family physician or to such physician as the policyholder designated, upon whom the task of repairing the machine devolved. What was the result? At the end of four years, an actuarial analysis showed that among those found impaired the death rate had been only 97 per cent of that upon which premiums are based, or since they were impaired risks, or about 50 per cent of that reasonably to be expected, allowing for the impairments. In other words, if these risks had not come under the system of periodic health examinations the mortality would have been double that actually experienced. Making all possible allowance for the smallness of the group and the short duration of the experience, an emphatic saving of life was demonstrated. Even among those reported unimpaired, a very low mortality was experienced, as many of these people were on the border line of impairment or were not living hygienically and were guided accordingly.

This system has since been made available to all insurance companies and to the general public as well by the recent establishment of the Life Extension Institute, Inc., through the efforts of Mr. Harold A. Ley, a prominent business man of Springfield, Mass., and Prof. Irving Fisher, of Yale. These gentlemen have enlisted the aid of ex-President Taft as Chairman of the Board of Directors, Mr. E. E. Rittenhouse as President, Surgeon-General Gorgas, and nearly one hundred of the leading scientists and publicists in this country and abroad as a Hygiene Reference Board to assist in guiding the scientific and educational policy.

Regular inspection of the human machine, therefore, will soon include a large proportion of the population and no doubt become in time a commonplace and commonsense measure, just as obviously necessary to individual and social welfare as the inspection of banks and insurance companies, and of the various machines that are likely to go wrong and kill.

If the human machine is found to be out of repair, what next?

When an ordinary machine is out of repair, we use common sense in selecting a repairer. If it is an electrically-driven machine, we send for an electrician; if it is the plumbing, we send for the plumber; but when the human machine is out of order, we ask our neighbor or the druggist or even the office boy for advice until pain finally drives us to the human repairer—the physician—who is expected to undo all the harm that our procrastination has wrought.

Surely, a patient enjoys more keenly being kept alive and well than having a learned diagnosis made, out of which he can extract no satisfaction except the morbid consciousness that he is an "interesting" and utterly hopeless "case."

It is better not to become a "case." It is well to have our "works" regularly inspected, so that the repair man can be called in time if he is needed.

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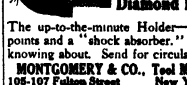
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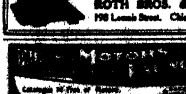
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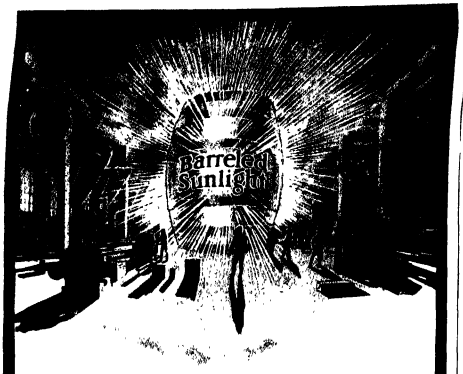


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Rice's Mill White made a trade name of the words, "Mill White." There is no substitute for it. None of its imitations has its elastic, permanent qualities. No other paint manufacturer can use the Rice process. Rice's Mill White for ten years has proved itself unequalled for illuminating power, sanitary qualities and low ultimate cost.

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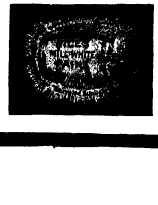
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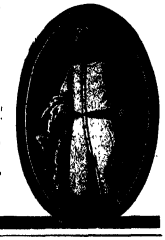
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SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

NEW YORK, JULY 11, 1914

PRICE 10 CENTS $3.00 A YEAR

A Boy's Model of a Battleship

By William M. Clardy

SAMUEL ORKIN, a Boston boy, who has been in this country but nine years, has built a battleship model, which because of its wonderful detail and suggestions for invention has won the personal praise of Secretary of the Navy Josephus Daniels. Orkin has spent eighteen months perfecting his model. It is nine feet long and about 20 inches wide and, except for suggestions for improvements as a model, it is a duplicate of the super-dreadnoughts, "Arkansas," "Wyoming," and "Texas."

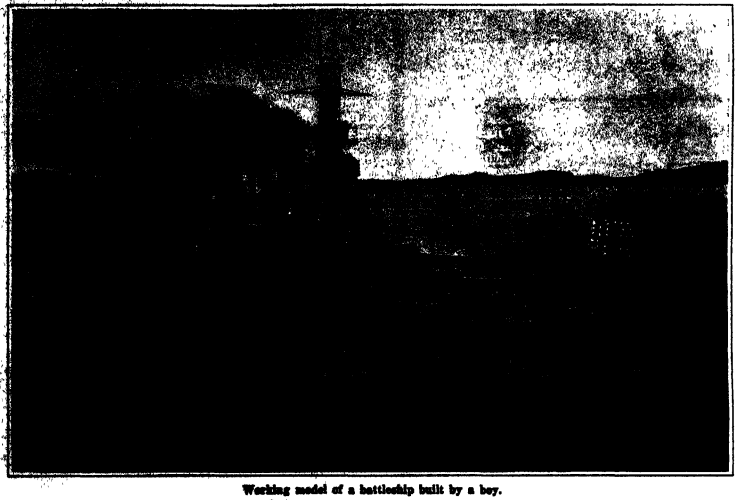
Orkin has arranged a system of endless chains under the decks, so that when the boat is in action miniature sailors pace back and forth, opening doors of the cabin and closing them as they come out, and saluting superiors as they pass them. Flags on the forward and aft decks are hoisted and lowered at frequent intervals, the anchor is hauled up and lowered, and as often as is desired a phonographic arrangement below sends forth the strains of "The American Patrol." While Orkin is going on a band comes in appearance on the aft deck and when the musicians the [illegible]

[illegible] that a realistic touch is added. There are three smokestacks, as in the "Connecticut," which at frequent intervals pour out black clouds, as though stokers were at work in the stokeholes below.

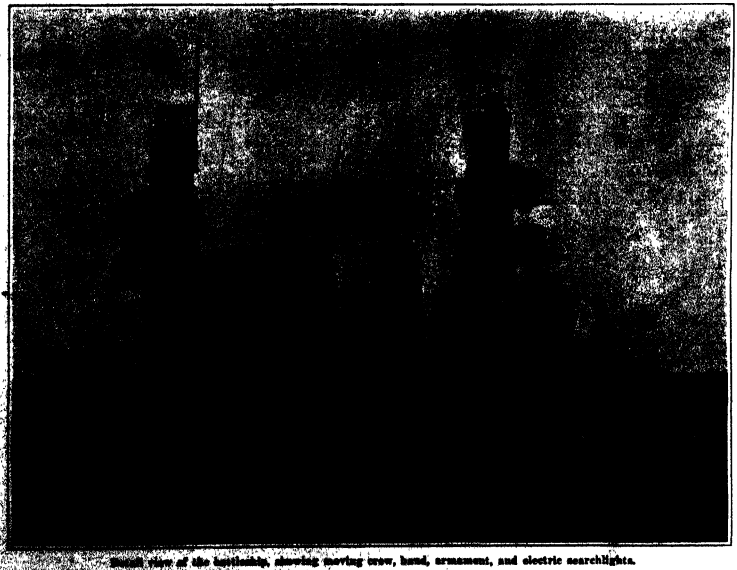
The model is equipped with three guns to a turret. There are eight torpedo tubes. The turrets are so arranged that all the big guns can be trained on the same spot at once and fired, or they can be fired in different directions if desired.

There are two one-pound semi-automatic guns, and two aeroplane guns, Krupp's model. Six miniature sailors man each of the aeroplane guns and there are two at each of the others. There is a magazine capacity of 1,000 cartridges of 0.38 and 0.22 caliber, and 250 shots can be fired from the semi-automatics without reloading. Another feature of the boat is an array of 15 searchlights, which Orkin made himself. The craft is automatically steered. He can put the craft in a lake and keep it going in all directions for half an hour or longer.

The motive power for the boat and novel equipment is supplied by seven electric motors, especially designed, and the current is furnished by an eight-volt storage battery designed especially for maintaining a steady voltage.



Working model of a battleship built by a boy.



Bow view of the battleship, showing moving crew, hand, armament, and electric searchlights.

A two-year-old plantation of Douglas fir on the Oregon national forest shows 94 per cent of the trees living. Extensive plantings of young trees in Washington and Oregon are costing only $8 an acre. Direct seeding of lodgepole pine has been successful without exception on the Arapaho national forest, Colorado. Several of the areas sown two and three years ago show from five thousand to ten thousand seedlings per acre.

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the *facts authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Battleship Versus Submarine and Aeroplane

SIR PERCY SCOTT, to whom perhaps more than to anyone else the great punishing power of the modern battleship is due, has proclaimed in a London daily that the day of the battleship is over, having been brought to a close by the deadly efficiency of the aeroplane and the submarine.

If the gallant admiral had made this statement in an after-dinner speech, we could have understood it. Some day Sir Percy's statement may hold true; that it is true to-day will be stoutly disputed by ninety-nine out of every hundred naval officers and expert lay writers on naval topics.

As a matter of fact, in spite of their remarkable accomplishments, both the aeroplane and the submarine are not yet far removed from the embryonic stage. As for the aeroplane and the airship, we are inclined to doubt that they will ever be a serious menace to a battleship fleet maneuvering upon the high seas, for under these conditions the range and accuracy of modern gun fire will prevent aerial "navies" from coming within effective bomb-dropping range.

The menace of the submarine, however, is really serious; but not in its present Lilliputian stage of development. The trouble with the submarine is that it is altogether too small and too slow for deep-sea cruising and for the fighting of deep-sea battles. When it has reached a displacement of 3,000 tons and can steam at destroyer speed, the type will realize its unquestioned latent destructive power. Then the battleship will have to look to its laurels.

For many years we have believed that the effective answer to the battleship will be, not the submarine, but the submersible. It would be quite possible, even to-day, to build a submersible, designed always to run awash, of 3,000 to 3,500 tons, with a speed of 27 knots and carrying five torpedo tubes arranged in its nose for end-on fire. Oil fired boilers, small, high-speed turbines, and mechanical reduction gear, would make it possible to put the necessary power into a submersible of this displacement, and still leave room for the accommodation of the necessary ammunition and crew. Such a ship, carrying a curved 6-inch deck, would be able to make a quick dash across the modern 10,000 yard fighting range between two battleship fleets, without the enemy having one chance in one hundred of stopping it. At 27 knots, the range would change so rapidly that the sighting of the guns would be hazhazard; and so flat is the trajectory of modern projectiles, that if by chance they hit, they would strike well within the minimum angle of thirty degrees, below which penetration is impossible and the shell glances off. Such a submersible (which would merely be a refined and enlarged Ammen ram, using the torpedo in place of the ram) would be certain to get within point-blank range of 1,500 to 2,000 yards, at which it could make sure of driving every one of its five torpedoes against the hull of the battleship selected for attack.

The nation which first develops a craft of this size, speed, and power will gain a lead over all other nations, and will produce a revolution in naval construction, greater than that which occurred when Great Britain put out the first dreadnought.

Over-regulating the Railroads

IT is always possible to carry a good thing too far, and we believe that this has been done in the matter of government regulation of the railroads. As our readers are well aware, the SCIENTIFIC AMERICAN was an earnest advocate of the formation of the Interstate Commerce Commission, and from time to time has strongly urged the strengthening of the hands of the Commission to the extent of enabling it not only to recommend, but to enforce such changes and improvements as it thought necessary.

For the present at least, the Interstate Commerce Commission may well rest on its laurels; and in proof of this it is necessary only to refer to its work in bringing about the universal use of the automatic car coupler and the air brake; its promotion of automatic block signaling and the automatic train stop; its efficient organization for the expert examination and analysis of train accidents; and, lastly, its notable work in the prevention of rebates and in the general regulation of interstate commerce.

So far, so good.

To-day, however, there are unmistakable signs that this movement for the regulation of the railroads has gathered an impetus which is carrying it too fast and too far. There is a growing conviction among the wiser and more level-headed of the men who have given close attention to the matter, that reform has been carried to a point at which the railroads are not receiving a "square deal." We refer to the question of freight rates and the request of the Eastern railroads that they be permitted to make a sufficient increase to enable them to maintain the existing properties in first-class condition, and make such extensions as the rapid growth of the country in population, industry, and commerce demands.

The most convincing arguments on behalf of the railroads are those of the lately-appointed president of the New York, New Haven and Hartford Railroad Company, Mr. Howard Elliott; and the following facts, as recently put forward by him in a public utterance, are worthy of most thorough consideration.

There can be no doubt whatever that there is an intimate relation between the prosperity of the railroads and the prosperity of the country at large. The transportation business in the United States comes second in importance among the great commercial interests of the country. According to the last census, there were over forty-one billion dollars invested in agriculture, about twenty billions invested in transportation, and about nineteen billions in manufacture. The interests of the three are so closely inter-related that they must rise and fall together. If we were asked to name the particular one upon which the prosperity of the country most nearly depended, we should unhesitatingly name the railroads. For of what avail are huge crops and a vast output of manufactures, if the railroads are unable to distribute them swiftly and economically between producer and consumer?

In an article recently published in the Chicago *Herald*, Mr. Elliott draws attention to the fact that the railroad is never finished and cannot stand still. It must improve or depreciate; and if it is to go forward, that means a constant investment every day in the year. He states that, in round figures, for every dollar in increase of gross earnings of the railroads of the United States as a whole, at least six dollars of new capital is required, and he asks where the railroads are going to get this money. They must either save it, earn it, or borrow it. They cannot save it because of the increase in the cost of labor and materials and the more luxurious facilities now demanded by the public, and because the law-givers, representing the public, have shown little tendency to give any help in the way of increasing the price that the railroads are allowed to charge for their service. Thus, for the year ending June 30th, 1914, the New Haven road paid $2,500,000 more than they did for the year ending June 30th, 1910, for the same amount of labor. This alone represents 5 per cent on $50,000,000. Again, if the New Haven could have obtained the same rates of wages in 1913 as it did in 1903, its payroll would have been $7,200,000 less.

Coincidentally with these increasing expenses, there has been a fall in freight rates. If the New Haven had received the same freight rates in 1913 as it did in 1903, it would have received for the same service $1,800,000 more. These two items represent a difference of $9,000,000. Furthermore, although in twenty years railroad taxes have increased 228 per cent, there has been no corresponding increase in freight rates.

The argument for giving the railroads a square deal in this matter of freight rates becomes absolutely unanswerable, when we bear in mind the fact that the construction and operation of our railroads have been, and are now being carried on so efficiently and at so low a cost, as to make them the wonder and admiration of foreign railroad companies. That this is no exaggeration is proved by the cold statistical figures. We have in the United States a railroad system of 250,000 miles, which has been built so [illegible] invested represents only [illegible] England it represents $214,000 per mile, [illegible] many $114,000 per mile. [illegible] pigeon of our railroads is [illegible] with an average pay of $570 per year per [illegible] $936 per year in Germany. But it is [illegible] the matter of freight rates that the [illegible] tion of our railroad system stands out most [illegible] conspicuous; for whereas the average [illegible] per ton per mile to the people of the United States for hauling a ton [illegible] one mile is three quarters of a cent, is [illegible] 2½ cents in England and 1½ cents in Germany. In other words, we have built up our railroads for less than one fourth of the cost per mile of the English railroads, we pay our employees over two and one half times as much in wages per man, and yet we are carrying freight at one third the rate charged in that country.

No one who is in the least acquainted with the railroad situation and the agitation for government control will accuse Mr. Brandeis of undue partiality for the railroad side of this question. Very significant, then, was a statement in his brief presented to the Interstate Commerce Commission at the rate hearings, in which he said, "On the whole, the net income and net operating revenue of the railroads in official classification territory is smaller than is consistent with their assured prosperity and the welfare of the community."

The Tercentenary of Logarithms

"EFFICIENCY" and "labor-saving" are the slogans of to-day. Yet one of the greatest and certainly one of the most ingenious labor-saving devices is this year celebrating its three-hundredth anniversary. Perhaps only an astronomer can fully appreciate the significance of the discovery in 1614, by John Napier, of a system of logarithms. Without logarithms it is doubtful whether Kepler could, in his lifetime, have completed the calculations which led to the formulation of "Kepler's laws," and Newton would thus have been deprived of the principal basis from which to derive his inverse square law of gravitation. And without logarithms the computations of modern astronomy would be utterly impossible.

If the intensity of the astronomer's need for logarithms is the more acute, the total volume of their utility is perhaps greatest to the engineering profession, which, of course, far outnumbers the rather small group of the world's astronomers. True, the engineer often finds the slide rule sufficient for his needs, but the slide rule is merely a mechanical adaptation of logarithms. The only practical substitute for a table of logarithms is a calculating machine. But a good machine of this kind costs several hundred dollars. A table of logarithms can be procured for a few cents.

It is sometimes said that great discoveries and inventions have always come just when the time is ripe for them, and that if one man had not made the decisive step in advance, another would have done so almost as soon. In a sense, this may be said to apply to the invention of logarithms, for a Swiss watchmaker, Jobst Bürgi, a contemporary of John Napier, independently prepared a similar set of tables, also involving the principle of logarithms. Which of the two, Napier or Bürgi, first conceived the idea is a matter of some uncertainty. This, however, is beyond question, that Napier's work was much more perfect, and that Bürgi never realised the full significance of his discovery. In point of date of publication Napier has about six years in his favor.

Elimination of a City's Filth and Flies

THE fly does its deadly work of carrying disease germs to food so stealthily that man has been wholly unsuspecting. Even when he does learn the truth, it is difficult to believe the treachery of an animal that has lived for centuries in such intimate relationship with mankind. Had man been less trusting, the repeated accounts of the association of flies with plagues and pestilence recorded in the Bible might have caused him to learn the truth long before he did.

Knowledge of the fly's deadliness and belief in the possibility of ridding our habitations of the fly pest must precede action. But how can that knowledge and that belief be instilled? On another page of this issue will be found an instructive article, which tells how the problem was successfully attacked in the city of Cleveland. From the first the idea uppermost in the minds of those who led the Cleveland campaign, has been to unite the efforts of the whole community to do the train-work, as it were, in destroying the fly. So successful was the plan adopted that confessions of all sides were heard that the reduction of the flies in the past summer had led many people to change their minds on the ultimate elimination of flies from the city. The conversion of business men, especially those dealing in food products, was gratifying because the burden of the work naturally falls on the man whose merchandise is exposed to flies.

Shipbuilding

[illegible] Hamburg-Amerika "Imperator," the largest steamship to be equipped with mechanical reversing gear, was recently launched for the Ameer Line. She is of over 14,000 tons gross, and will have twin screws driven by Parsons turbines through helical gearing. A sister ship, the "Tirpitz," is being built for the same service.

A Ten-Million Cubic Foot Gas-Holder.—What is believed to be the largest of the many huge gas-holders in existence, is one completed in 1910 for the Newtown Gas Company, Borough of Queens, New York city. The holder is 261 feet in diameter and 275 feet high. Such is the height of this vast cylinder that it is a familiar landmark for many miles around New York city.

The Pottinger Transformer.—It is stated that the Pöttinger hydraulic transformer, or reduction gear, is receiving a wide application in Germany. The Vulcan Company are equipping the new Imperial yacht "Ersatz Hohenzollern," of 7,000 horse-power, the cruiser "Ersatz Gefion," of 45,000 horse-power, and three German destroyers with a total of 75,000 horse-power with this type of reduction gear.

Magnitude of the Culebra Slides.—It is estimated that altogether 280 acres of ground lying outside of the prism of the Panama Canal and containing over 30,000,000 cubic yards of material, have swept down into the canal. This material would be sufficient to build a wall seven feet thick and seven feet high, reaching from New York to San Francisco, and it would fill a million and a half of the big Lidgerwood cars, making a train that would extend for a distance of twelve thousand miles.

Trial Trip Results of the "Vaterland."—We have received the official statistics of the results obtained on the trial trip of the "Vaterland." The displacement of the ship was 58,500 tons, and, on this displacement, with a horse-power of 90,700, the ship made an average of 25.84 knots for four hours. To accomplish this, the whole of the battery of 46 boilers was in use. On her maiden trip, the displacement varied from 63,500 to 56,000 tons, and the average horse-power was 63,000.

The Reliability of Modern Heavy Ordnance.—As showing the excellent workmanship which goes into the modern heavy naval gun, it may be noted that the whole of the 15-inch guns for the five British battleships of the Queen Elizabeth type were ordered without any trial gun being made and tested. When the first 15-inch gun was tried out, the results agreed exactly with the calculations of the designer. It is stated that it is the best and most accurate gun of all ranges that has yet been built for the British navy. The explosive charge of the shell, which weighs nearly 2,000 pounds, is 50 per cent larger than that of the 13.5-inch guns which preceded it.

Sloop versus Cutter Rig.—It is interesting to note that in both the challenging English and the defending American yachts, in this year's contest for the America's Cup, there is a tendency to return to one of the distinguishing characteristics of the original "sloop" rig. We refer to the use of a single head rig. The first adoption of the cutter rig by the defending yachts occurred in the "Puritan"—"Genesta" races of 1885, when the "Puritan" carried both jib and foresail. The shifting of the mast forward in modern "single-stickers," has brought back the single head rig. "Resolute," "Defiance" and "Shamrock IV." have tried it, but "Resolute" and "Shamrock IV." have returned to the cutter rig. "Vanitie" is cutter rigged and will remain so.

Anchoring Houses in Flood Districts forms the subject of a useful circular issued by the Texas Agricultural Stations (P. O.: College Station, Brazos Co., Tex.). Its publication is timely, in view of the many houses that were carried away by recent floods on the Brazos and Colorado Rivers. Similar occurrences are, of course, common in all great floods, and cause much loss of life, as well as of property. The circular in question gives detailed descriptions and drawings, together with estimates of cost, for two kinds of pier for anchoring houses in bottom lands. The simplest device consists of an upright post standing on two horizontal posts forming a cross, and buried six feet in the ground; the whole being tied together and to the floor of the house with an iron rod. The other plan provides for a pier of reinforced concrete.

The Failure of the Hatchtown Reservoir, Utah.—On the night of May 25th, the Hatchtown Reservoir, on the Sevier River, Utah, 220 miles south of Salt Lake City, failed. According to *Engineering News*, the leakage was noted by the watchman at the downstream toe of the dam, near the end of the outlet culvert. This developed into several small streams; and, later, large sections of the lower face began to slip off and wash away. At 7:30 in the evening, from 120 to 140 feet of the dam went out, releasing over 600,000 cubic feet of water, which had a depth at this point of nearly 40 feet. The immediate cause of the break was leakage along the outer surface of the outlet culvert. The dam has a maximum height of 60 feet deep, and a length along the crest of 760 feet. The dam was built of earth.

Electricity

Electrolytic Iron.—It has taken quite a while to make electrolytic iron of use in the industries, because it was filled with hydrogen due to the action of the current in the process. This makes it brittle and unsuitable for practical work, so that inventors have been trying to get rid of the hydrogen and to make a metal of the usual quality. At the coming Lyons Exhibition, samples of the new iron are to be presented, in the shape of seamless iron pipe, which possesses great tenacity and ductility.

Moving the Western Union Telegraph Station.—The old building, which has housed the Western Union Telegraph Company in New York since 1875, is now being taken down to make room for a more modern structure. The telegraph company has moved to new quarters. Moving a large station such as this, with 2,500 wires and over a thousand employees handling 150,000 messages per day, was no small matter. Promptly at midnight on Saturday, June 27th, the moving commenced. During the slack hours of Sunday the transfer was completed, and the operators had a chance to become acquainted with their new surroundings.

Wireless Finder for Fog-Bound Boats.—The steamer "Royal George," of the Canadian Northern has been equipped with a Marconi-Bellini-Tosi radio-goniometer which will enable it to determine the direction of an approaching steamer, provided it is sending out radio-telegraph signals. This consists of two triangular aerials, bisecting each other at right angles. In the base of each triangle is a coil. These crossed coils constitute the primaries of a transformer of which the secondary is a pivoted coil connected with the receiving detector. The secondary coil is turned to the position that produces the loudest signals in the receiver, when it will point directly at the source of the waves. A number of other vessels have been equipped with this apparatus in the past few years. It should prove invaluable in a fog when the direction of sound signals is so uncertain.

Extracting Casein Electrolytically.—An electrolytic process now serves to extract casein from milk, according to a French authority. This is carried out in the following way: In the center of a large tank full of skimmed milk and heated to 80 deg. Cent. place a porous vessel containing a 50 per cent solution of caustic soda, dipping into the porous vessel an iron cathode. For the anode, a carbon plate is immersed in the tank. The current causes the casein to be thrown down from the milk, and it is claimed that the new process is much more economical than those used hitherto; because the use of acids or rennet was necessary. Besides, casein thus prepared contains no foreign substances and is very pure. It serves, among others, to manufacture "galalith," which is a hard white material intended to replace celluloid, ivory, and the like.

Oxide-Insulated Copper Wire.—The use of the surface coat of oxide on aluminium wire in order to produce insulation for electrical purposes is gaining ground, and what is more, the process is now beginning to be applied to copper wire. As regards insulation, cotton, silk, rubber and the like are easily injured by heating. "Enameled" wire will not stand a heat of over 120 deg. Cent., as the coating has the nature of varnish. Asbestos is irregular, and too thick for many uses. We are familiar with the oxide coat on aluminium wire, and this gives an adherent, thin, flexible and good insulating layer. Recent tests made in German works show that such wire can stand a heat of 300 to 400 deg. Cent., and the layer of oxide adheres so strongly that the wire must be scraped with a knife in order to remove it. Electromagnets are now made with this wire, and it is also used for traction motors, etc. More recently, the same process serves for copper wire. Copper wire takes a coat of aluminium by a suitable process, then the surface is oxydised by dipping in a bath of ammonium borate.

The Electrocution of Noxious Insects.—A new machine has just been invented by an engineer, Mr. Friggeri, for the destruction of insects. This electric machine has been tried at Palacios, in the province of Santa Fe in the Argentine Republic. On a carriage that it is easy to transport, Mr. Friggeri places a gasolene motor and an alternating current generator. At the back of the carriage a drum is placed, on which about 200 meters of insulated cable have been rolled. This cable carries the current to a metallic net or system fixed upon a little vehicle with two wheels, and which carries in its center a transformer that is destined to raise the tension to 6,000 volts and even more. The metallic circuit is established between a pole and the dynamo formed by a stem of iron fixed into the ground and the net. After several trials, which have all been crowned with success, the experiments at Palacios were considered as decisive. Indeed, not only has it been possible to destroy the grasshoppers but also their eggs, which are to be found buried more than 2 centimeters deep in the ground. With the same apparatus provided with a metallic broom worked at the end of insulated handle, and which is joined to the positive pole of the transformer, it is also possible to completely clean the trees attacked by insect parasites.

Science

Gift to the Shackleton Expedition.—Sir James Caird, a Dundee millionaire, has just given the sum of £24,000 toward the expenses of Shackleton's forthcoming trans-antarctic expedition.

An International Institute for Geographical Exploration has been established at Christiania. It will include a laboratory for the equipment of exploring expeditions, and will devote special attention to polar research.

Production of Ultra-Violet Rays.—An economic method of producing ultra-violet rays has been described before the French Academy. The oscillating spark is used as the source of the rays, and for this the metal invar is better than aluminium. The energy is greater with invar. A great frequency is not necessary, twenty sparks per second furnishing good results.

Artificial Rubber Proposed as a By-Product of Steel Making.—It appears that at a recent meeting of the Iron and Steel Institute, in London, the president, in a paper on by-products in steel manufacture, discussed utilizing the gases of blast furnaces for sundry purposes, including the synthetic production of India rubber from coke oven gases, and stated that efforts were being made to obtain from coke oven gases the hydrocarbons, the derivatives of which were found in India rubber, and that experiments already made fore-shadowed manufacture of artificial rubber.

Prehistoric Man as a Sculptor.—Prof. Capitan now finds that prehistoric man was able to model in clay with considerable artistic skill. We are already familiar with the remarkable cave drawings of animals which were made at such epochs, but this appears to be the first time that we have evidence of models in relief. He found these in a cave in the Ariège district of France, and two bisons are thus reproduced in high relief. Among others, are engraved animals upon stones, all seeming to date from the Magdalenian epoch, or about 30,000 years ago. Animals instead of men were probably drawn for purposes of incantation, so as to give power over the animals, and some are seen pierced with an arrow.

A Scientific Study of Noise.—The question of different kinds of noises from a practical point of view, and with special reference to automobile horns was considered by Prof. Marage at a recent meeting of the Académie des Sciences. He investigated the subject by executing pieces of music upon ancient and modern instruments, before a number of persons chosen from all professions. The general result was that high-pitched sounds produced a more disagreeable impression than those of low pitch, and since it appears that the grave sounds are more agreeable to the ear he recommends that such sounds be used for signals as much as possible. In fact, the use of the siren has been prohibited in many European towns. He thinks that automobiles should have two kinds of signals, one a grave sound for city use which does not annoy the passers, and a loud and shrill sound for use in the country which sound will carry to a long distance.

Antarctica or Antarctia.—Although "Lippincott's Gazetteer" and the supplement to the "Century Cyclopedia of Names" define the name "Antarctica" as synonymous with "the Antarctic regions," or the whole area lying inside the Antarctic circle, no such use of this name is current among geographers, who (following, we believe, Sir John Murray) apply the name "Antarctica" to the supposed Antarctic continent. It is, of course, primarily a Latin adjective, meaning "antarctic," and when it is used as a noun we must understand with it the word "terra." Dr. Ludwig Mecking has recently urged the claims of "Antarctia" as a more satisfactory name for this continent, especially when it comes to forming a corresponding adjective. "Antarctia" and "Antarctian" are the natural analogues of "Australia" and "Australian," "Asia" and "Asian," etc. "America" is only an apparent exception, since it did not, of course, originate as a feminine Latin adjective.

The Effects of Sulphur on Plant Growth.—Sulphur is commonly used to protect vines from oidium, and it has long been noticed that, when thus used, it has a stimulating effect on the growth of the vines. The experiments of several French investigators have now made clear how this effect is brought about. Sulphur does not act directly as a plant food, but breaks down complex nitrogenous substances in the soil to the ammonia form. Hence its action is dependent upon the presence and amount of organic matter in the soil. Thus Vermorel and Dantony treated wheat and beans, grown in pots, with sulphur. When nitrogen was also applied in the form of nitrates the addition of sulphur led to no increase in yield, but when the same quantity of nitrogen was supplied in an organic form (dried blood) an increase of 30 per cent was noted for wheat and 60 per cent for beans. The most recent and conclusive experiments on this subject are those of Prof. Chauzit, at Villefranche-sur-Saône, where half-acre plots of vines were treated. The effects of the sulphur were markedly less in proportion to the time that had elapsed since the vines had been manured, and were increased by mixing the sulphur with the manure.

The Martinsyde Transatlantic Challenger Monoplane

An English Machine Designed to Compete for the Northcliffe Prize

By Major H. Bannerman-Phillips

THE late Mr. Gustav Hamel hoped to attempt a flight across the Atlantic Ocean this summer in an aeroplane built by Martin & Handasyde.

It was intended that the flight should be made from Newfoundland to Ireland, and the machine was to be ready for trial by the end of June or the beginning of July. Unfortunately, Mr. Hamel's untimely end has led to the abandonment of the entire scheme. The interest in transatlantic flying is such that a description of the machine should be placed on record. The machine was to be of the type, generally speaking, known as the Martinsyde monoplane, and was being constructed in duplicate at Brooklands at the cost of Mr. Mackay Edgar, the owner of the well-known motor-boat "Maple Leaf."

Mr. Hamel was to have been accompanied by an experienced navigator in the person of some officer of the merchant service who had made many transatlantic voyages, and under whose guidance Mr. Hamel proposed to fly in the track of the liners which are crossing regularly between Europe and North America, on the supposition that by following such a course he would seldom be out of sight of a ship. At a height of 1,000 to 1,500 feet any vessel within a radius of 30 miles should be visible in clear weather, and the height to which the machine could ascend was to carry it clear of the fogs on the Newfoundland Banks, which would otherwise have been troublesome at the start.

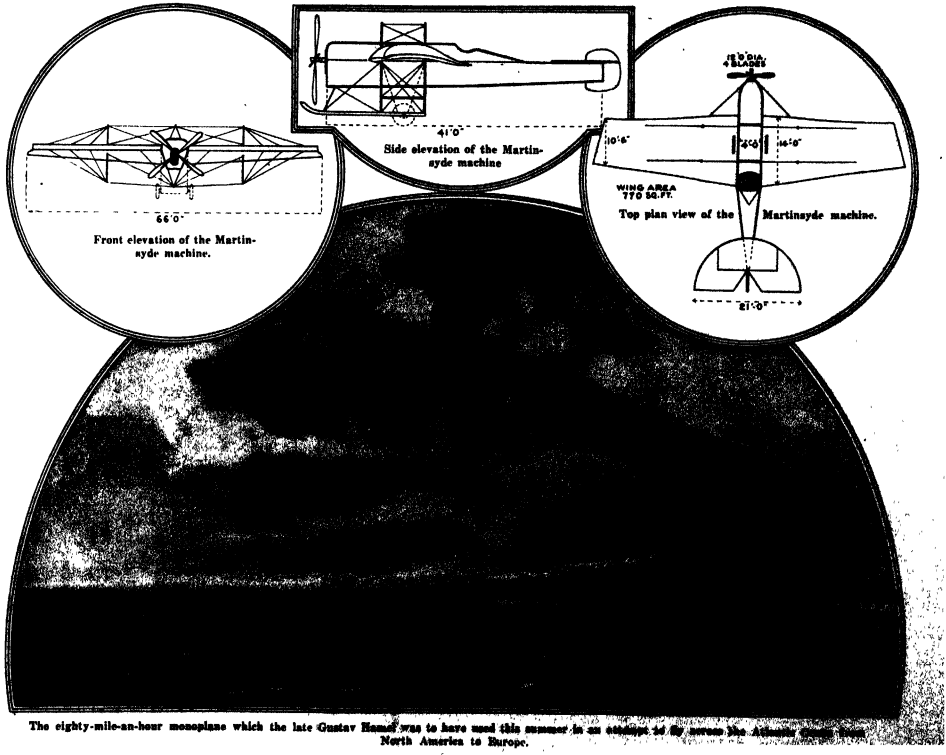
The estimated speed of the machine in calm weather was to have been 80 to 85 miles per hour, and fuel for 25 hours was to have been carried in a very large gasoline tank of 330 gallons capacity. This, with the wings and a watertight compartment, which in itself was to have a flotational capacity of nearly twice the full load of the machine, was calculated to be capable of sustaining the monoplane on the surface of the sea in case it should have had to come down in mid-Atlantic. There was no intention of descending, however, between start and finish unless necessity or accident compelled such a course. The machine was not a seaplane, and had no floats which would enable it to travel on the surface of the water. Even the wheeled chassis with which it was fitted to enable it to run along the ground in order to gather speed for its first leap into the air, was to be so constructed that the pilot, by pulling a lever, could cause it to drop clean off the fuselage, and thus reduce the useful load of the monoplane when once clear of the land. There would then remain for landing purposes a large central skid and two lower king-posts and skids, sufficient for the purpose, since the machine would be much lighter at the end of the journey than at the beginning, on account of the consumption of fuel, and therefore able to make a slow landing.

The accompanying illustrations may be considered to give a fairly correct idea of the monoplane as it would have appeared in mid-air over the Atlantic after the chassis had been dropped, but some items were still under consideration at the time of Hamel's disappearance. The span of the planes was 66 feet over all, of 14 feet 6 inches chord at the roots of the wings, tapering to 10 feet 6 inches at the tips, with a total surface of about 770 square feet, and the trailing edge was 3 feet longer than the leading edge. The plane section was peculiar in that the top of the wing between the spars, instead of following a continuous curve, was quite flat. The engine was to be a 12-cylinder Sunbeam of 215 horse-power nominal, which would drive a 4-bladed propeller of 9 feet [illegible] pitch, at [illegible] revolutions per minute. Covered in by a [illegible] cowl, this was to be fixed in the front of the fuselage, [illegible] was a water-tight bulkhead or partition and a [illegible] similar bulkhead was fitted about 14 feet [illegible] Aft of this the construction of the fuselage [illegible] was usual type, with the ordinary struts and [illegible] but exceptionally strong.

The seats for pilot and navigator were [illegible] side by side, level with the trailing edge of the [illegible] and at the after end of the 14-foot water-tight [illegible] formed by the two bulkheads. Near the [illegible] end of this compartment the front spars of the wings cross the upper longerons of the fuselage and about midway the rear spars enter the latter beneath the longerons, the ends of the spars meeting on the center-line. From the points of entrance of the spars into the fuselage a couple of inverted struts started, which met on the central skid. These were to carry the main bracing wires of the wings. The gasoline tank was strung from the spar butts by means of a pair of longerons attached to them.

The system of wing-bracing was so designed as to make of the wings, together with both the upright and inverted struts, bracing-posts and bracing-wires a complete box-girder, with tension applied below as well as above the wings. This should have given a unit of great strength for the support of the main item of weight to be carried, namely, the huge gasoline tank with its contents. Compared with this the weight of the engine and the human freight was of minor importance. The total weight of the monoplane, fully

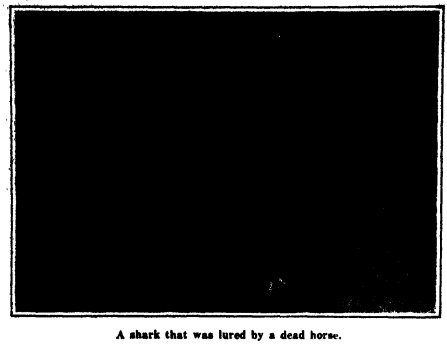
(Concluded on page 14.)



The eighty-mile-an-hour monoplane which the late Gustav Hamel was to have used this summer in an attempt to fly across the Atlantic Ocean from North America to Europe.



An underwater fight with a shark.



A shark that was lured by a dead horse.

Taking Moving Pictures at the Bottom of the Ocean

A Remarkable Photographic Feat and How It Was Accomplished

By J. E. Williamson

THE marvels that Jules Verne saw through the prescient eyes of his vivid, Gallic imagination, the Williamson brothers are now seeing through the eye of a camera at the bottom of the sea. They have accomplished the conquest of the deep, with the aid of a novel submarine tube and of the photographic camera.

Twelve months ago the SCIENTIFIC AMERICAN published a group of remarkable snapshots made under the water at the bottom of Hampton Roads, Virginia the first successful photographs ever made under the sea. This photographic accomplishment was notable, as it opened up to the eye of the camera a virgin field of startling significance—a field having a superficial area of 148,000,000 square miles. The submarine apparatus which made possible the easy access to this underwater world is most worthy of note, beginning as it does, a new era of enterprise, reducing to a minimum the risk, and eliminating all physical strain This device allows anyone to step from the deck of a vessel and climb down through an open airshaft to any desired depth, and there look and reach out and carry on within limits, any work he may wish to accomplish This invention, in its basic principle, is a revelation in marine construction, and is the invention of Charles Williamson, father of the present writer Through its use the first practical submarine pictures were made and in the past few months a marvelous motion picture film has been produced with this apparatus—the Williamson submarine tube. Its flexible metallic construction makes a habitable hole in the water down and through which the camera man passes to his subaqueous studio to work for hours under normal atmospheric conditions.

I had been down in this tube, and from the workchamber at its base looked through the port lights and had seen the fish in their native element. With experi-

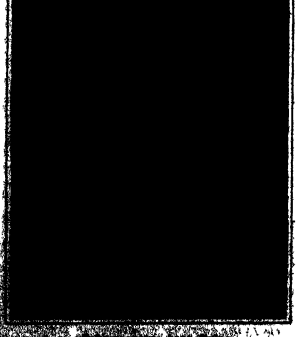


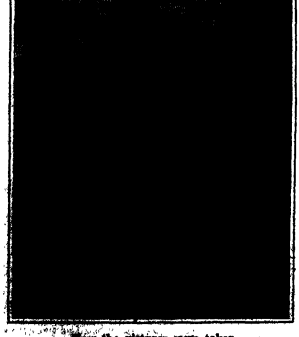
The underwater photographic gallery.

ence gained as a newspaper photographer, my faculty for getting a news-picture was keenly developed, but it was not until the enormous possibilities of a motion-picture film of this new and fascinating realm were realized that the project of submarine photography was started. A few sleepless nights, and, with the co-operation of my brother, our plan of action was formulated We knew the clear water of the tropics, abounding with plant and animal life, would be the place to obtain the best results. To fit out an expedition to go to these waters equipped with the necessary vessel, a powerful submarine lighting outfit, a Williamson tube and operating chamber for photographic work at its base, was a big undertaking. So it was necessary to carry on experiments near our home at Norfolk to prove that we were right in our assumptions and gain the interest and support of capital

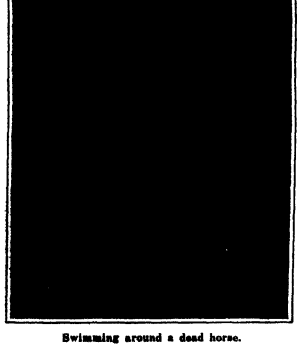
The organization of a corporation in Norfolk,Va., with T. S. Southgate as president, was the result of successful experiments that followed, and after seven months' work of preparation our expedition was in readiness for launching. We wanted the best motion-picture camera man for the important work to be done, and finally secured the services of Carl L Gregory. With the West Indies as our destination, we started. Headquarters were made in the beautiful harbor of Nassau, in the Bahamas, and we made many trips from there to the nearby islands around whose treacherous coral reefs are found beneath the sea the beautiful, picturesque, and thrilling scenes we desired to capture and embalm forever on the retina of our deep-sea camera.

Pictures were made at night with the aid of our submarine lamps. They were each equipped with a 2,400 candle-power Cooper Hewitt quartz burner, and the results obtained, as the films show, are remarkably successful. The exposure used for these night pictures was about the same as that used in daytime, the average time of exposure being 100th part of a second. Wonderful results were obtained at various depths of from 15 to 60 feet. A striking example is shown on the cover of this issue; a diver snapped at work on an old wreck. Forty-five feet of water was between him and the camera, and the reef in the background, 75 feet away, is clearly in focus





Where the pictures were taken.



Swimming around a dead horse.

Ten thousand feet of film was taken on the expedition; 5,000 feet of this will be selected to show the best results of the many interesting subjects portrayed. Combats between sharks and divers will furnish some of the thrills for the production. The big fellows will be shown fighting for pieces of flesh thrown overboard, tearing at each other in their efforts to get at the food. A naked diver will slip into the affray, and as the shark turns over to attack him, he will plunge a knife into the vital part of the monster. Myriads of striped and odd-shaped tropical fish will be seen darting in and out among beautiful coral reefs and the waving flora of the sea. Queer and unusual plant formations, bending and rippling in the swift currents of the marvelous sea gardens, will be flashed on the screen, and for the first time a clear and life-like view of what the bottom of the sea is actually like will be shown. A surface scene will show the passenger steamers leaving Nassau, and the native black boys sculling and diving from their small boats. Then the scene will shift beneath the surface, and the natives will be seen diving for coins thrown overboard, grasping them, in many instances, before they reach the bottom. The practical diver will also make his first under-water appearance before the world as recorded by the camera man who turned the crank in the operating chamber at the bottom of the tube while the amphibious human went about his work. As he strolls around the wreck of an old blockade runner, hundreds of fish swim about him, and the stream of bubbles issuing from his helmet grow in size as they approach the surface and the pressure is lessened. Many people of note will be shown boarding the "Jules Verne," the odd-shaped operating craft of the expedition which controls the surface end of the big flexible tube. When the visitors go below they witness with delight the marvelous panorama that unfolds itself before their wondering eyes, after which the submarine tube is unfolded, section by section, to demonstrate how easy access to the secrets of the deep is obtained.

These pictures make a vitally interesting page in natural history, and, as submarine work is continued with the Williamson tube, more new and strange sights will be seen. The ever-ready camera man will do his work, and millions will see exactly what he saw and depicted.

What the grass shack of prehistoric man is to the Woolworth Building, or the first dug-out of primitive man is to the gigantic ocean liners of to-day, the present apparatus that we are using—the first Williamson collapsible tube—and the results obtained, will be to the amazing evolution of this submarine device in the future. To photograph the bottom of the sea is, perhaps, the last of the big things to be done on this hoary planet, and undoubtedly it will be done.

Two Giant Worlds

By Frederic Campbell, Sc.D., Former President Department of Astronomy, Brooklyn Institute of Arts and Sciences.

OF all the twenty first-magnitude stars, the inherent glory of Rigel and Canopus is the greatest. Only two are farther than they, while the other sixteen are very much nearer. Antares is 112 light-years distant, its light requiring that number of years to travel to earth; and the next beyond are Rigel and Canopus, 460 light-years distant. Though it takes almost half a millennium to bring us their messages of light, even as perceived from earth Rigel ranks seventh and Canopus second among the entire heavenly host.

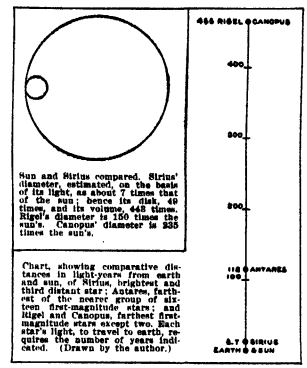
Former estimates gave the light of Rigel as equal to that of 4,000 + suns, and that of Canopus as 10,000 +; but, because the computation of their distance has multiplied it by 2 1/3, considering that the light received from them is unchanged, their inherent light must be multiplied by the square of 2 1/3, or about 5 1/2 times. At the lowest estimate this makes Rigel equal 22,000, and Canopus 55,000 suns.

Brightest of all as seen from earth, Sirius, 8.7 light-years distant, is the third nearest star of the heavens, the second nearest among those of first magnitude, and the nearest among those of the latter seen from our northern regions. It is interesting, therefore, to estimate how bright Rigel and Canopus would appear were they as near as Sirius. Now, their distance is 53.5 times that of Sirius; hence, to bring either of them that much nearer would be to increase its light by multiplying by the square of that figure, or 2,862.25; and as, according to Table A, given below, we now receive from Rigel 18 per cent and from Canopus 52 per cent as much light as from Sirius, we multiply these figures by our 2,862.25, in order to discover that, at Sirius's distance, Rigel would display 515 and Canopus 1,488 times the splendor of Sirius. Such disparity is now utterly unknown among the first-magnitude stars, Sirius, the brightest, being only 15 times as brilliant as Regulus, the faintest. Charmed as mankind has always been with the magnificence of Sirius, what would it be to behold two stars displaying, respectively, 515 and 1,488 times that splendor?

But eleven times as bright as Sirius shines the planet Venus when brightest, next to the moon and sun in effulgence. We have, therefore, only to divide those figures by 11, in order to ascertain that Rigel and Canopus, brought to the proximity of Sirius, would display, respectively, 47 and 135 times the marvelous splendor of Venus. Inasmuch as Venus may often be recognized by daylight, it follows that Rigel and Canopus would be plainly visible even in the glare of the sun.

A step farther. The full moon is 1,727 times as bright as Venus. Consequently, dividing by this number, we ascertain that Rigel and Canopus, brought as near as Sirius, would possess, the former 2.7 per cent and the latter 7.8 per cent, as much light as that of the full moon. The latter figures mean that even the full moon would outshine Canopus only about 15 times, which is nearly the relation of Sirius to Regulus. Any frequent observer of the full moon knows how its light actually dazzles and partially blinds him. Were the new positions of Rigel and Canopus such as would bring the moon into their vicinity, think of the wonder of an occultation, when the moon would draw near, touch, then extinguish the luminary, and it would spring from behind it an hour later! Think also of the infinitely charming spectacle of a close conjunction, with its star and crescent effect!

Inasmuch as Sirius, despite its comparative nearness, is still so distant that the largest telescope cannot sensibly magnify its point of light, we feel the need of bringing Rigel and Canopus yet nearer, and setting them beside the expanded disk of our own sun, in order to obtain a true measure of their size. According to the subjoined table, Sirius possesses 48 times the light of the sun. Provided that its general surface brilliancy is the same as that of the sun, we have only to extract the square root of that figure in order to ascertain that its diameter is about 7 times that of the sun. This does



Sun and Sirius compared. Sirius' diameter, estimated, on the basis of its light, as about 7 times that of the sun; hence its disk, 49 times, and its volume, 448 times. Rigel's diameter is 150 times the sun's. Canopus' diameter is 235 times the sun's.

Chart, showing comparative distances in light-years from earth and sun, of Sirius, brightest and third nearest star; Antares, farthest of the nearer group of sixteen first-magnitude stars; and Rigel and Canopus, farthest first-magnitude stars except two. Each star's light, to travel to earth, requires the number of years indicated. (Drawn by the author.)

not sound as great as it looks in the accompanying drawing; and it does not look as great as it ought, for the drawing merely shows Sirius's disk 49 times the sun's, whereas its volume would be 7 × 49 times the sun's volume. The latter is 1¼ million times the volume of the earth. Thus we get some conception of the enormous size of Sirius.

But we are speaking of two giant worlds enormously larger yet. Assuming that their general surface brilliancy is the same as that of the sun, and recalling that Rigel has at least 22,000 and Canopus 55,000 times the light of the sun, the square root of those figures gives us Rigel's diameter 150, and Canopus's 235 times that of the sun. Whereas the sun's diameter, as seen in the sky, measures one half a degree, Canopus's, at the same distance, would measure 117½ degrees of the 180 that reach from horizon to horizon, and its disk would cover 55,225 times the sky area occupied by the sun. Canopus would be nearly eight hours in rising, and, before being fully risen, would already have begun to set; that is, its disk would reach much farther than from the eastern horizon to the zenith. With such a globe brought so near, all life on the earth would instantly perish, seas would be converted into steam, and the very mountains would melt with fervent heat and flow like molten iron. Beside such facts, our corner of the universe seems diminutive, dull, and insignificant.

These two marvelous orbs have been found among a group of twenty to which they belong. Out of the million-million stars known to exist, any twenty, for aught we know, might yield similar specimens. Nothing proves that such worlds are rare. We have not magnified their greatness by bringing them, in the first instance, into unreasonable proximity, but merely to that of their present greatest rival, Sirius, the primate of the order to which they belong, to reach which, even at the inconceivable velocity of light, would require a journey of [illegible] years. Were we to place the sun in the second rank, we have only to remove it to the proximity of the stars, or [illegible] which itself could be received, at the [illegible] less than 177 years.

If the [illegible] mind will brood over the [illegible] presented in the [illegible] table, [illegible] inexorable law of our thinking which requires [illegible] cause, but an adequate cause, for every [illegible] cannot fail to observe that, just at the final point, where we are insistently demanding what or who [illegible] of this tremendous universe, science, having conducted us thus far, gathers up its portfolio and bows itself off the scene.

TABLE OF THREE FIRST-MAGNITUDE STARS.

A. The facts as such.

Rank.	Name.	Magnitude.	Light Received.	Distance in Light-years.	Brilliancy × Sirius.
1	Sirius.....	−1 6	100	8.7	48
7	Rigel.....	0.3	18	460	22,000 +
2	Canopus.....	−0.9	52	460	55,000 +

B. If Rigel and Canopus were as near as Sirius.

Rank.	Name.	Distance in Light-years	Brilliancy × Sirius.	Brilliancy × Venus.	Brilliancy × Full Moon.
3	Sirius.....	8.7	1	.	....
2	Rigel.....	8 7	515	47	.027
1	Canopus....	8 7	1,488	135	.078

The Ninth International Congress of Applied Chemistry

FROM a personal letter by the president of this congress, Herr Prof. Dr. Paul Walden, it is stated the following is the order of events to be carried out:

1. The meeting will be held in St. Petersburg, from the 8th to the 14th of August, 1915.

2. Excursions are to be made to Finland, Moscow, Kiew, Baku, in the Caucasus, etc.

3. In addition to the usual addresses, systematic reviews of the work in particular fields (with discussions) are to be given by specialists, on the invitation of the committee of organization, to a greater extent than formerly.

4. Particulars as to receptions, entertainments, etc., will be announced later on.

5. The question of reduced railway fares on the Russian railways is now under consideration by the government.

6. No obstacles will be placed in the way of the journey of Jewish chemists to the congress provided (a) that at the frontier, in addition to the revised passport (requisite for every passenger) cards of membership, signed by the president and honorary secretary of the Ninth International Congress, shall have been presented.

7. An announcement in English of the Ninth International Congress will be forwarded during this summer to North America and England.

A Remarkable Test of the "America"

TEN men, weighing 1,542 pounds, flew in the transatlantic hydroaeroplane "America" in a blinding rainstorm and a 65-mile wind, at Hammondsport, on June 29th. This is not only the greatest number of passengers ever carried in a hydroaeroplane, in the world, but ever carried in an aeroplane in this country. The load, including passengers, gasoline and instruments, weighed 1,705 pounds. This is within 500 pounds of what the craft will have to carry for her over-ocean flight.

On July 2nd Glenn H. Curtiss made four flights in the "America" with 2,107 pounds of useful load, more than will be needed in the flight across the Atlantic. The "America" is to have new planing fins extending out from each side over the present bottom. Mr. Curtiss does not anticipate any difficulty in getting a load off the water after the change.

The pontoons that Mr. Curtiss built for Dr. Langley's old aerodrome were detached from the old machine and bolted to the Wanamaker flier under the lower [illegible] added water planing surfaces, in order to [illegible] trial referred to. Such pontoons are [illegible] purposes. The keel bottom will be [illegible] slightly concaved on the lower side.

Correspondence

[Communications will be published under this heading for statements regarding matters of interest to our readers. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Skyscraper Construction Wrecking Building

To the Editor of the SCIENTIFIC AMERICAN:

The SCIENTIFIC AMERICAN of June 13th refers to a scheme for dampening in buildings "devised by a German engineer," and consisting in sawing longitudinally and transversely the walls and progressively inserting impermeable plates. In 1876 I did this to a building, still standing, at 867 Rhode Island Avenue, this city. The "machine" consisted of a discarded sawmill saw, propelled by two darkies, one inside and the other outside the building. As the cutting progressed, I dipped slate slabs in cement and drove into the cut with a mallet. It fully remedied the trouble.

Washington, D. C. CHARLES E. FOSTER.

New Zealand's Big Things

To the Editor of the SCIENTIFIC AMERICAN:

There is a statement in "Extra Tropical Plants," by Baron von Mueller, Victoria, Australia, that *Eucalyptus amygdalina* was measured up to 471 feet from the ground by Mr. G. W. Robinson, surveyor at Mt. Baw Baw, Victoria. There is a photograph of a redwood in the museum here; height given, under 440 feet; diameter, 38 feet. The Encyclopedia Britannica and Chambers both give the same relative proportions, the diameter being greater in the redwood. In the same museum we have the moa bird, at 14 feet height, and the blue whale, at a length of 87 feet, caught at Okarito, West Coast, the tree, moa, and whale being world records.

Christchurch, New Zealand. FREDERICK ELSOM.

Testing Speed of Yachts by Log

To the Editor of the SCIENTIFIC AMERICAN:

In the eighties I belonged to an amateur crew that sailed in the fastest catboat in New England waters. We took some twenty prizes in one season, mostly first, and a few second prizes. I often raced against Mr. Adams. Now, I claim that the best professional or amateur yachtsman cannot determine the exact speed of a boat without the use of a log. Some models will foot fast when pointing up well into the wind; others will have to have more sheet to foot well.

Now wouldn't it be a good plan for the three boats to use a log to know when they are sailing the fastest with the different trim of the sails? I have never heard of a log being used; but I think where the boats are so nearly matched it would be an excellent plan, and the *only* way to determine their exact speed. I am rather diffident about making suggestions to such able skippers as are handling *these yachts*; but my experience in racing craft and interest in the cup defense causes me to write this letter. FRED. BRADLEE ABBOT.

Sharon, Mass.

Confusion in Wireless Messages

To the Editor of the SCIENTIFIC AMERICAN:

The comments made in your correspondence column of June 6th, 1914, do not alter the conclusions expressed in my communication of May 16th, 1914. If various inefficient conditions, such as improper spacing, are assumed to be tolerated, there are, of course, many combinations of code letters which may be mistaken, for after all is said, the code is merely a combination of dots, dashes, and time intervals made intelligible solely by a predetermined and proper sequence.

I must take exception to the remarks of the last paragraph of the last criticism; even if all possible tones were in use (which is, in my opinion, not the case, certainly not with the apparatus I employ) it would still be a simple matter to designate a combination covering a sufficient error due to inaccuracies in imperfect apparatus, by international regulation, just as certain wavelengths have already been assigned for particular purposes. The method which I have mentioned is really very simple and contemplates no "endless undertaking," because repeated adjustments are not necessary nor desirable. Evidently, the latter statement of the column of June 6th, 1914, assumes that no modification or improvement on the older apparatus now in use entered into the question, which, as I have indicated, is not the case.

Minneapolis, Minn. PHILIP E. EDELMAN.

Technical Writing by Untechnical Men

To the Editor of the SCIENTIFIC AMERICAN:

In the May issue of a high-class, conservative monthly there appeared an article, called "Skyscraper." It struck my risibilities to such an extent that I have attempted to put in writing the impression which it gave me. I present the result.

"TECHNICAL WRITING BY UNTECHNICAL MEN.

"The old brick building had vanished . . . in a cloud of broken brick (mixed of brick)" and plaster.

Already the muddy floor was dotted with the toadstool *tombs* of the excavators. . . . Far down in the *stifling* air of the caisson" (stifled with oxygen), "the concrete roots were being planted, *tied with cement* and steel to the very core of the world."

"The foundations were finished and the first thin columns" (weighing possibly one ton per foot) "stretched upward. In ordered plan, the cross beams *fell* into their places, and the great lattice of the substructure" (that *is to say*, superstructure) "shaped itself."

"On the topmost story, the derricks crouched like giant spiders, thin legs braced against post" (or was it column?) "and I-beam. Untiring, hour after hour, the derricks lifted *bales of* steel, and as each story was *bolted* down" (by the pneumatic riveters) "the derricks lifted themselves heavily to the new level. . . ."

"Like beetles, the steel workers clambered surefooted over the empty frame. Like flies they caught the slim-spun threads of the derricks and swung up to some inaccessible" (although they did get there) "height."

"Day faded in fog and darkness. Like beacon fires the forges of the workers glowed intermittently" (showing conclusively that scab-labor was being employed).

"I am thinking also of the other workers of men who measured this tall tower on their *slide rules*" (and worked out the formula for long columns on their tape measures). "Engineers who foresaw each bolt and fitted so perfectly mass on mass" (without any previous experience and) "with only imagination and their books of figures to guide them. . . . workers in the steel mills of the distant city who molded" (or perhaps rolled) "each beam and pillar to go together like a watch—theirs is the silent forgotten labor!"

Let us hope that these *nocturnes* by untechnical men will be as soon forgotten!

Does the reading public really demand these inebriatent writings? We had thought not, so long as they were confined to the Sunday Supplement; but it does little good, apparently, to appeal from Philip drunk to Philip sober when an article such as that from which we have just quoted, appears in one of the most conservative of monthlies.

Surely this is an era of adjectives, and extravagant style. Let us quote once more: "Angry clatter—shattering reverberation—gaunt frame—casting their threads of steel softly—the building surged higher—slim-spun threads—blinked red—agyatic blue prints—trail of jarveled fire—automobile lights streaked the gleaming blackness—panting breaths of red—wisps of steam—smear of smoke."

Is it any wonder that, as the author of these words stood on the dome clutching the flag-pole, the steeplejack, who stood beside him, said, "Don't break off that pole, I've got to climb it"?

CHARLES S. RINDSFOOS,
Secretary-Treasurer the Foundation Company.
New York.

Wireless and Sound Prevention of Collision in Fog

To the Editor of the SCIENTIFIC AMERICAN:

The many recent collisions at sea in a fog between steamship have started a great many inquiries, suggestions, and criticisms of the present rules and regulations of navigation. In all this controversy, however, there is but one obvious fact, namely, few ships, if any, are absolutely unsinkable. There are a few ocean liners of the latest double shell construction which, should they be injured as the "Empress of Ireland" was, might remain afloat for a few hours. But these few modern boats are such a small percentage of the entire shipping world that they form a negligible quantity of safe ships. Admitting for a moment that these double-sided latest steamers are absolutely safe, it would be impossible to reconstruct all other ships to make them also unsinkable. Therefore, in order to avoid repetitions of the latest disasters at sea in a fog, there *seems to be* but one remedy: to bring ships to a standstill until the fog lifts and then proceed on their courses. As this would not be practicable for obvious reasons, the only other solution to prevent collisions would be to definitely establish the distance separating two ships and their respective courses, for if they knew the exact distance they were apart and knew the direction each one was proceeding in, it would be impossible for them to collide. Therefore, the following method of establishing the distance and direction of navigation between two ships seems to me a simple solution of the problem.

In the first place, it is, of course, necessary to have every ship equipped with wireless telegraphy, and as almost every liner to-day has this installation, it would be a simple and wise move to make it compulsory by law.

Now, supposs two steamers are at sea in a heavy fog and one half mile apart. Ship number one signals with her fog horn, and at the same instant a wireless signal is sent out. Wireless being practically instantaneous compared to sound, which travels at 1,090 feet per second, ship number two receives the wireless message first, and then, after a lapse of about 2½ seconds, the horn signal is heard. The difference in time between the receipt of these two different signals will immediately show the second boat how far away steamer number one is, and at the same time the direction of travel could also be noted by exchanging wireless messages. If the two vessels, when say a quarter of a mile apart, were required by law to come to a dead stop, how could there ever be a collision so long as there was no headway?

New York. CARL A. BROSSEL.

[A similar proposal was made by another reader of the SCIENTIFIC AMERICAN, whose letter we have published.—EDITOR.]

Night Warnings for Steamship Passengers

To the Editor of the SCIENTIFIC AMERICAN:

I have long thought of a possible way of arranging a practical means whereby passengers could be warned at night when the greater majority are in their cabins asleep.

Having traveled a good deal on board ship as a passenger, it has frequently been impressed on my mind, that should any accident happen during those hours, we (the passengers) would have a poor chance of being saved, or in some cases of even knowing anything untoward was happening, as no doubt occurred in this latest disaster. The shock, as a general rule, is "very slight"—or "is scarcely felt," according to evidence given by survivors.

If the practical use of my idea will put traveling on board ship on a safer basis than formerly, so much will have been accomplished This would consist of an electric device, such as is in use in private homes; simple in action and dependable, and wherever the individual may be, the warning will reach them through it, whether under the passenger list heading or belonging to the ship's company, and they will have as much warning as the officer on duty himself who is directing operations at the time of any accident

This will be accomplished by pressing a single button on the bridge. The indication board showing the numbers of the cabins, positions, etc., could be placed where most convenient on the bridge, and upon the officer pressing it, a corresponding "red light" and "loud bell buzzer" (or bell buzzer only) would be instantly set in motion in every cabin, *cook's galley, storeroom*, engineer's quarters, engine-room, and so on. Firemen in the stokehold, who are in very great danger indeed, would thus receive just as much warning as any first-class passenger. Then, by the individual pressing a button (wherever that individual might be), her or his corresponding red light would go out or show clear on the indicating board on the bridge as well as stopping buzzer in the cabin. The indication board, as before stated, would necessarily be placed where the officer of the watch could see it directly. Wherever a button was pressed anywhere on the ship, a corresponding red light would go out, or turn clear at the officer's end, thus indicating in the quickest possible way who had vacated, and who were still between decks.

It also could be installed for the chief steward's use (or whoever might be deputed to such duty), and placed where convenient for such an emergency, when he could direct his men to those cabins not yet heard from The officer and the steward would thus be looking at different boards, indicating clearly and simultaneously, identical in every particular.

Also each individual, on getting up and stopping his own buzzer but hearing one still working on either side of him, could cause additional warning to his fellow-traveler, by hammering on the partition with his fists (or anything handy).

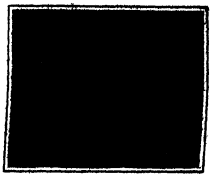
During any voyage "false alarms" could be inaugurated, to see that every individual was familiar with the use of the "safety device," and a small fine imposed on everyone failing to answer "the call," the proceeds to be placed in the Sailors' Institute Fund, or for a similar good cause

This lamentable wreck of the "Empress of Ireland" (according to paper reports) "might have been prevented." Capt Henry George Kendall, in relating his story of the disaster, is reported to have said that "from the time when he saw his ship was in imminent danger to the time it sank, occupied about nineteen minutes." This would certainly have been ample time for every passenger to have reached the deck at least, and a possibility of ultimate rescue when they were thrown into the water, if the aforesaid "safety device" had been in use.

If a system such as I have described has been spoken of heretofore, I have not heard or read of it. But if someone has done so, why has it not been adopted? Actual cash should hardly figure where human lives are at stake, and, anyway, the wiring for lighting purposes is in the cabin, and could possibly be utilized in conjunction with "the call." G. M. RUSSELL.

Seattle, Wash.

Germany is said to have an over-supply of foresters; so that well-educated men have hard work to secure even inferior positions.

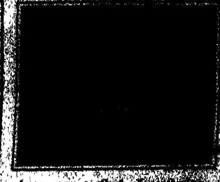


It was not necessary to rectify unsanitary conditions about homes that had children attending the school.

Eliminating a City's Filth and Flies

Cleveland Battles Against the House-Fly

By Jean Dawson, Ph.D.



A common method of [illegible] garbage. In fighting flies this is but one of many conditions [illegible].

FOR the past two years a campaign has been waged to put Cleveland on the map as a flyless city. The work has moved forward with vigor. Human brain and effort have been pitted, not against the fly's wisdom and cunning, but against its marvelous powers of reproduction, which man must calculate by geometrical progression. The Cleveland public have been stimulated to do battle against the fly from March to January, with the result that they have held the fly in check to a marked degree. The methods of attack have been three-fold, i. e., killing the over-wintering fly before it has a chance to breed; trapping and poisoning those that have escaped and are breeding in the city; ridding the city of the organic filth in which flies can breed.

In the previous campaign, the city fought flies by the first two methods alone. But we have felt that reducing the number of flies after they have hatched is much like a person sopping up water from an open faucet, in itself a necessary step, but not a permanent measure. The second year of our campaign we determined to go deeper and strike at the roots of the fly nuisance, and it was with the hope of closing the faucet by cleaning away the fly's breeding places, and thus effectually ridding the city forever of the greatest carrier of disease known to medical science, that the work of the campaign of 1913 was continued into midwinter, when frost and snow made the public forget the pests that infect the summer months.

Increased Confidence.

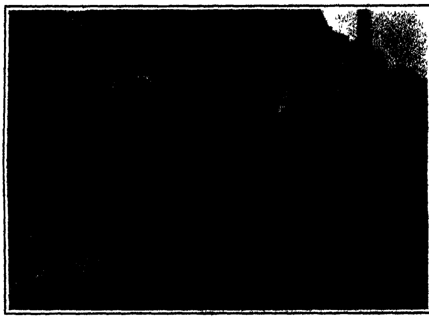
With a year's experience to draw upon, we started the campaign, with added hope and not a little assurance, for we had gained unmistakable ground. Thanks to a number of forces at work, we have changed a scoffing, skeptical public, who thought that you might as well try to stop the wind from blowing as to try to rid a community of flies, into one that believes at least that there is something in it. Perhaps a year's hard work may seem a high price to pay for a grain of faith. It should be remembered, however, that we are fighting the traditions and teachings of centuries. From the beginning we have been imbued with the belief in the harmlessness of the fly. Who cannot remember the poems and songs written to eulogize the innocence of this insect? Nor is this harmful teaching at an end. With a world-wide agitation against the fly, we still find a large book company putting a revised second reader into our schools, with the poem, "Baby Bye." This, too, in the face of the fact that scientists are telling us that the fly is more deadly than all the lions, tigers, and snakes in the world. Think of a child, at its most impressionable age, learning the following stanzas:

"He can eat bread and meat,
See his mouth between his feet!
On his back is a sack
Like a peddler's pack
Does the baby understand?
Then the fly shall kiss her hand.
Put a crumb on her thumb,
Maybe he will come

Round and round on the ground,
On the ceiling he is found,
Catch him? No Let him go
Never hurt him so!
Now you see his wings of silk
Drabbled in the baby's milk,
Fie! oh, fie! foolish fly!
How will you get dry?"

The fly does its deadly work of carrying disease germs to food so stealthily that man has been wholly unsuspecting. Even when he does learn the truth, it is difficult to believe the treachery of an animal that has lived for centuries in such intimate relationship with mankind. Had man been less trusting, the repeated accounts of the association of flies with plagues and pestilence recorded in the Bible might have caused him to learn the truth long before he did.

Knowledge and belief must precede action. From the first the idea uppermost in our minds has been to unite the efforts of the whole community to do team work, as it were, in destroying the fly. It has been, therefore, with a good deal of pleasure that we heard confessions on all sides that the reduction of the flies in the past summer had led many people to change their minds on the ultimate elimination of flies from the city. The conversion of business men, especially those dealing in food products, was gratifying because the burden of the work naturally falls on the men whose merchandise is attractive to flies. One man, who has spent nearly a half century in the Cleveland markets, confessed that it gave him a genuine shock when he first heard of our intentions to rid the city of flies. "I thought the idea was wild enough to have originated in the Newburgh asylum. I couldn't imagine a summer without flies. But I want to apologize.



Junior sanitary policemen discussing with a neighboring landlord ways and means of removing filth in which flies are breeding.

"When I saw how well the traps worked and how they reduced the number of flies in our market, I went to work in earnest, and now there is no cleaner market in the city." It was true. This same man added: "I was brought up in the country, and I could not believe that flies breed in stable refuse, until I kept some manure in a closed box for a few days and actually saw the flies hatching and crawling up with their wings so wet that it was some time before they could fly. I am satisfied now," he added, "and you need never worry about any flies breeding about our stables."

Heading Them Off

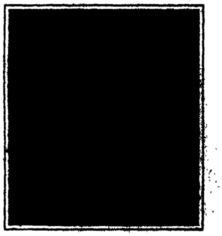
The previous year the killing of the over-wintering or mother fly had been so successful in noticeably reducing the fly population that it was unanimously agreed to repeat the winter campaign. The distribution of 200,000 swatters among the schools of the city, together with the offer of ten cents a hundred for all flies brought to the Anti-fly Headquarters in the city hall, served to put a bounty on the head of every fly that ventured from its hiding place. Boys spent their leisure hours in the most likely places for flies, while little girls carried their swatters back and forth to school, so as to be ready for an unwary fly that might cross their path. The presence of a fly in a school-room caused so much excitement that work had to be suspended until the fly was dispatched. To avoid undue disturbance, one teacher made the rule that the first child who saw a fly should leave his seat and get the swatter without attracting unnecessary attention.

In all about $500 was spent, representing a catch of fifty thousand mother flies which, had they lived to lay eggs, would have filled the city with a plague of insects. Of the fifty thousand flies killed in the early spring, the great majority were blue and green bottles, a much larger proportion than the previous year. These flies seem to breed earlier than the house-fly. At any rate, it was not an uncommon thing to see a rose-bush or a vine covered with blue or green bottle-flies, that had just hatched in the fertiliser around the roots of these plants. Upon investigation the fertiliser used was found to be dried blood, a product of our local packing houses.

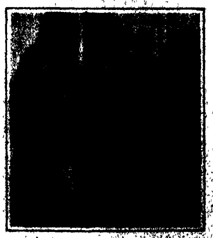
Creating Public Sentiment

The business of swatting flies was not confined to the school world alone. It became a common topic of conversation in all parts of the city. The interest of the public was created largely by the activity of the newspapers. Through news items, human-interest stories, poems, songs, cartoons, and every device and art known to the newspaper world, the daily papers of the city kept the whole community united in an effort to rid itself of a common enemy. Forgetting business rivalry and their differences in political views, the public-spirited newspaper men of Cleveland did a constructive piece of work for the future good of the community, that may well be emulated by every city in America or, for that matter, the entire world.

The agitation against the house-fly is making the public very sensitive to the presence of flies. The owner of a number of fine delicatessen stores in the city remarked that he never had liked flies, but that they had not bothered him as they do now. "Why, the sight of a fly crawling on food fairly nauseates me." This same feeling is reflected in the child who wrote her teacher that she had to throw away her biscuit because a fly lighted on it, while she was eating. "I tell you the people of Cleveland don't appreciate the reduction of flies until they have been away from the city for a while," a young lawyer remarked last fall. "Business called me to the town of [illegible] for a [illegible], and do you know that I was [illegible] eaten alive fairly with flies. [illegible] through down there, [illegible] I had to [illegible] for a few days [illegible] I couldn't eat. [illegible]



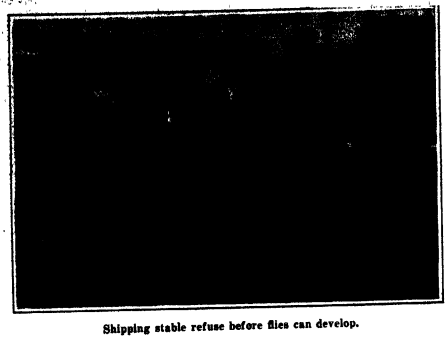
Flies breeding about neglected stable, back of Euclid Avenue store.



Girls, working in [illegible], [illegible] the unsanitary conditions of stables.



Fly-breeding places in the heart of the city.



Shipping stable refuse before flies can develop.

that the people did not seem to mind flies, I really don't believe they saw them."

It is a fact that a few flies seem many to the Cleveland people, but a sensitive public is one of the best assets in a fight to eliminate this insect. The day that we can produce a public with sufficient imagination to picture the flight of a fly, as it emerges from the filth from which it breeds to tubercular sputum in street and alley, thence to contaminate the food in restaurant, bake-shop, or grocery-store with its germ-laden feet, that day, and no sooner, will the fly-infested shop close its doors from lack of patronage.

Taking the Fly Census

About every two weeks during the summer young women were sent to the lunch-rooms, and to stores retailing food to gain an idea of the effort that was being put forth to keep the people's food from contamination. The young women estimated the number of flies in each place of business and learned the methods, if any, that were being used to fight the flies. To facilitate the work a printed blank was used:

Anti-fly Campaign.

Date .....
Street ..... No. .....
Kind of Store.....Restaurant.....
No. flies seen in 3 minutes' time.....
Remarks .....
Name of Inspector .....

For instance, August 13th, 1,138 groceries, meat markets, candy shops, restaurants, and miscellaneous food stores were inspected. Of these, 131 were free from flies, 487 had less than ten flies, 514 had more than ten, and less than fifty, and 6 had many. These results are due largely to the general reduction of flies in the city and not to the employment of the more modern methods of catching flies in traps. Indeed, few merchants were employing methods other than their fathers had employed before them. This is remarkable in that a few minutes spent in baiting a trap, placed on the outside of a store, would save hours of a man's time, and then, too, get the flies before they could enter and contaminate the food.

Women Responsible for Flies in Stores

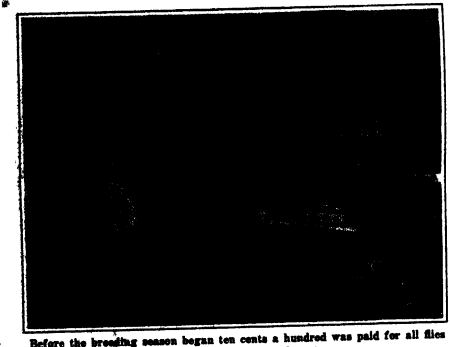
No census of the flyless homes was taken. It is safe to say, however, that had there been, the percentage of flyless homes would have far outnumbered the proportion of flyless stores. Perhaps this is due to woman's interest not extending beyond her home, or to diffidence on her part, which causes her to buy food in fly-infested stores with only inward protests.

Realizing that the sanitary conditions of the retail grocery store, meat market, bake shop, and milk depot is in the hands of the woman, who supplies the city's table, we printed the following card, which we hope will enable her to express her opinion to these merchants without embarrassment:

[illegible] sanitary conditions with to-day. I [illegible] flies in your store of [illegible]

A Customer.

Several of these cards inclosed with orders from a number of food customers would, we believe, cause a speedy elimination of flies from stores and fly-specks from the store windows. Men understand a customer's power to regulate conditions much better than women; hence it is not surprising to learn that the lunch-rooms that were freest from flies in the city were those that were frequented by business men. This result is brought about largely by the business man himself.



Before the breeding season began ten cents a hundred was paid for all flies brought to the anti-fly headquarters.

Protesting against flies in a down-town restaurant one day, a business man relates that the owner claimed that he could not help having a few flies. "I told him that it was up to him to find a way to get rid of his few, if he cared to retain the patronage of the people from our office." This same business man ventured the opinion that no matter what happened to the anti-fly movement, the people of Cleveland would never tolerate the flies in the lunch-rooms, restaurants, and hotels that they had in the past.

Children Aid in Cleaning the City

Before the Winter campaign was well over we began to enlist the interest of the children in other phases of the work of fighting flies. The pamphlet, "Questions About the Housefly," revised to include the results of the recent researches on the stable-fly was distributed to the school children, together with the following letter, which makes a direct appeal to each child to do seven specific things, to aid the city in its fight against the fly:

The Anti-fly Campaign.
March 28th, 1913

Dear Boys and Girls of Cleveland:

Do you know that much of the sickness and death in our city is unnecessary and that we can do away with it if we all work together to get rid of filth and flies?

Will you do your share and try to get others to help you to make Cleveland the first flyless city in America?

1 Will you learn about flies from a little book which will be given you? Will you loan this little book to others, who do not know when flies breed and how they carry diseases?

2 Will you get rid of every fly as fast as it comes from its place of hiding, remembering that to kill one fly in the spring before it lays its eggs is equal to killing thousands in August and September?

3. Will you tell everybody to keep flies away from sick people, because the flies carry germs from the sick to the well?

4 Will you clean up your yard and put all dirt and rubbish in baskets, cans or boxes, so that Mr. Hanna can carry it away?

5 Will you see that the garbage is covered, so that the flies will not come near your yard to feed or breed?

6. If you know where there is filth and dirt will you write a card to Mr Hanna at the city hall, or will you tell the Junior Sanitary Police of your school to see that it is cleaned away?

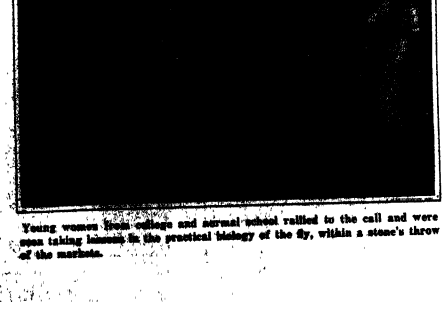
7 Will you remember that flies carry filth and disease germs on their feet to food and that clean food is just as cheap and less dangerous than food that is fly-specked? Will you tell your mother where you see flies crawling over food, so that she will not buy it? Very sincerely yours,

JEAN DAWSON, *Director.*

A letter was also sent to the principals of the grammar schools instructing them how to organize children in the upper grades to work for the improvement of the sanitary condition of their school district. School authorities did not urge the grammar schools to help in the work of ridding the city of filth and flies; neither did they hinder them—each school was left to act as time or inclination might prompt. Wherever principals and teachers were in sympathy with the work, the boys of the upper grades were organized into Junior Sanitary Police and the girls into Sanitary Aides. A group of the finest boys and girls was selected to lead the school; the boys to ferret out the unsanitary conditions in yards, alleys and vacant lots, and the girls to promote an absence of filth and flies in all stores where food was kept.

After the election of officers, each boy and each girl was given a portion of the school district to investigate, and later to report upon to his superior officer. Before reporting a case, however, he was to make every effort in a polite way, to get the work done.

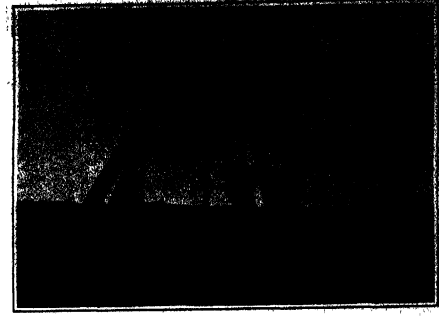
(Concluded on page 54.)



Young women from college and normal school rallied to the call and were seen taking lessons in the practical biology of the fly, within a stone's throw of the markets.



The operator sights the lamp, and when he has found his man, presses a button, thus causing the light in the mirror to flash.



One man is watching the light signals made by an aviator and another is preparing to answer.

Signaling With Electric Light in the Daytime

By Our Berlin Correspondent

THE light radiation from electric incandescent lamps, at extremely high temperatures, can be increased without any corresponding increase in the energy consumption. A proper utilization of this fact for lighting purposes is unfortunately impossible, the life of lamps decreasing rapidly in the process. But if the light be flashed, as in signaling, the phenomenon becomes of practical importance. A life of even a few hours is sufficient to give out thousands of signs. On this principle is based Prof. Donath's signal mirror.

The whole apparatus, inclusive of the battery, weighs only 11 pounds, and thus constitutes no appreciable surplus load for the soldier or an aeroplane It comprises the following main parts: 1, a mirror (reflector); 2, an incandescent lamp; 3, a lamp adjustment; 4, a sighting tube; 5, a handle, a switch, and leads; 6, an accumulator battery.

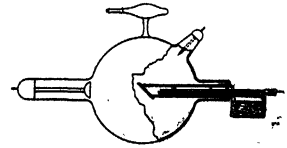
The minute incandescent lamp, provided with a special filament arrangement, is fitted into a small parabolic mirror along the axis of which it is arranged to be shifted so that the position in which a parallel beam of rays is sent out can be readily found. The operator points the sighting tube above the mirror toward the point which is to receive his signals, after which he makes contact by pressing the button of the mirror handle. The signals used in this connection may be those of the Morse code or conventional signs.

The possibility of giving out light signals in bright sunshine with such an immaterial energy consumption, of course, strikes the minds of those unacquainted with the apparatus as a paradox. Nevertheless, signals can be transmitted by day, under normal conditions, to about four and one quarter miles. A short flash corresponds to the dot, and a longer emission to the dash of the Morse alphabet, the duration of current closures being about two and six seconds, respectively; between each two signs there are intervals of about four seconds.

Gamma Rays Produced by Means of an X-ray Tube

LET us briefly refresh our memory with regard to the nature of the several radiations given out by radium, and commonly known as alpha, beta and gamma rays. The alpha rays have been shown to be atoms of helium carrying an electric charge, and shot out from radioactive materials in the course of their disintegration. The beta rays are "electrons," that is to say, elementary charges of negative electricity, emitted with a velocity approaching that of light. Both alpha and beta rays are thus "corpuscular" in character, there is actual transfer of a moving particle over the path of the radiation. Gamma rays, on the other hand, are not corpuscular, but undulatory, that is to say, they are propagated like waves. When a stone is dropped in a pond it starts a series of waves traveling outward. The individual particles of water merely oscillate up and down—there is no transfer of matter along the direction of propagation of the wave. Gamma rays, then, are such wave disturbances, and in point of fact they are of the same nature as X-rays, which in their turn are of the same nature as light, namely, electromagnetic waves carried by the ether. What distinguishes X-rays from light rays is the distance from crest to crest of each wave, which is much shorter in X-rays than in visible light radiation. Gamma rays, in their turn are of still shorter wave length than X-rays as ordinarily produced. All these relations are clearly presented in tabular form in a note which appeared in the SCIENTIFIC AMERICAN SUPPLEMENT for September 18th, 1913, p. 175.

The reader may ask: How is it possible to distinguish between such radiations of different wave-length? Without going into technical detail we may say briefly that X-rays of different wave-length are characterised



Arnheim X-ray tube with cathode cooled by atomised water.

by their varying "penetrating power" or "hardness," that is to say by the impression which they make upon a photographic plate or fluorescent screen after traversing various thicknesses of a medium which absorbs

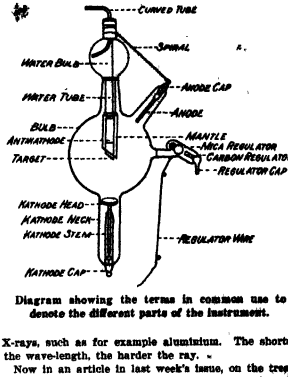
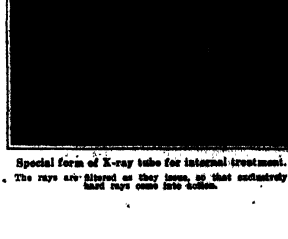


Diagram showing the terms in common use to denote the different parts of the instrument.

X-rays, such as for example aluminium. The shorter the wave-length, the harder the ray.

Now in an article in last week's issue, on the treatment of disease with X-rays, it was shown that the hardest rays obtainable are in several respects the best



Special form of X-ray tube for internal treatment. The rays are filtered as they issue, so that exclusively hard rays come into action.

adapted for the physician's needs. In this respect radium, with its gamma rays, seemed to offer a certain advantage over the use of X-rays as ordinarily produced. Until recently the hardest X-rays obtainable from a vacuum bulb had only about one twentieth of the penetrating power of gamma rays. Friedrich Dessauer of Frankfort-on-the-Main, has recently so perfected the X-ray tube that he can produce rays practically identical with gamma rays—the ratio of the hardness of the two being as 1:1.2. This result is obtained by employing a special and highly efficient device for cooling the anticathode, and by other precautions to be mentioned presently. For the benefit of those readers who are not familiar with the construction and operation of X-ray tubes it may here be explained that the electric current passing through an X-ray tube causes a stream of charged particles (not unlike alpha rays) to pass from a cathode to an anticathode. They strike the latter like a target, at a high velocity, and their impact causes X-rays to spread out from the target. This action has very aptly been likened to the effect of throwing pebbles against a barn door, from which sound waves are thus caused to be emitted.

The anticathode, in this bombarding process, becomes intensely hot, and various methods of cooling it have been introduced, since it is found that such cooling is essential for the production of hard rays. An obvious method which has been employed is to make the anticathode hollow and to circulate water in it. Dr. Arnheim, working in the institution of which Friedrich Dessauer is director, invented a greatly improved cooler, in which advantage is taken of the high latent heat of evaporation of water. A fine spray of water is conducted into the anticathode, where it rapidly evaporates. When we remember that in evaporating, one pound of water can lower no less than 536 pounds of water through 1 deg. Cent. (1.8 deg. Fahr.) we see how much more efficient this method is than mere cooling by circulation.

Other important factors in Dessauer's improved X-ray tube are the special method of introducing the current, the current density at the cathode, and other technical details.

A great advantage of the X-ray tube over radium as a source of gamma rays is that a powerful stream can be obtained at a cost of installation in incomparably less than that of the corresponding amount of radium which would be required to furnish the same stream of rays.

The Sperry Gyroscopic Stabiliser in France

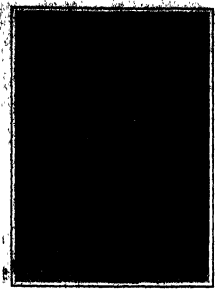
THE stabiliser invented by Elmer A. Sperry of New York, which was used on a Curtiss aeroplane in a safety contest on June 18th, was awarded the first prize of $10,000 offered by the French War Department. The second prize was awarded to the Paul Schmitt Aeroplane Company.

The contest on June 18th was a two hours' test on the Seine between Bessons and Argenteuil. Lawrence B. Sperry, son of the inventor, piloted the winning machine and had a mechanician to assist him. A large crowd watched the wonderful exhibition given by young Sperry.

Lawrence Sperry and his mechanician performed several wonderful feats while in the air. Young Sperry stood up in the machine with his arms folded, and Vachet, the mechanician, climbed to the end of the lower plane and back. Nevertheless, the balance of the machine was not destroyed. The Sperry stabiliser has been fully described and illustrated in the SUPPLEMENT, AMERICAN. A description of the Paul Schmitt biplane will soon appear.

A Hand-Propelled "Water Bicycle"

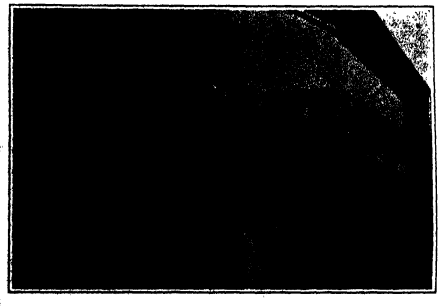
PROPULSION by the combined use of hands and feet is accomplished with a recently built catamaran for driving the propeller by hand. The photograph shows the operator at the rear, and for a view of the machine. The two pontoons are made of rubber and turbinoid cloth, and may be inflated with a common bicycle pump. They are connected by a light metal framework, which carries the seat and supports the driving mechanism. The full weight of the machine is twenty-eight pounds, and when collapsed it folds into a small parcel that can readily be carried about. By means of step-up gearing between the hand cranks and the propeller the latter may be driven at high speed. The boat is steered with the seat, which is connected with the rudder.



A hand-propelled catamaran.

A Monster Fog Horn

ALL the up-to-date light stations possess fog signals for warning the mariner of the presence of rocks and other dangers in foggy weather. The larger ones are so powerful that their blasts can be heard 25 to 30 miles out at sea. Most of them are worked by compressed air, a gas engine of perhaps 20 to 25 horse-power being brought into requisition for this purpose. The siren is blown periodically, every 70, 80, or 90 seconds or so, the actual blast lasting perhaps about 2 to 3 seconds. It means that while the siren is running, in the case of the larger apparatus, something like 500 horse-power is being expended in the production of sound! We get an idea of the tremendous size of the modern fog signaling apparatus by comparing the man in the photograph with a lighthouse fog trumpet through which the sound is directed over the waters.

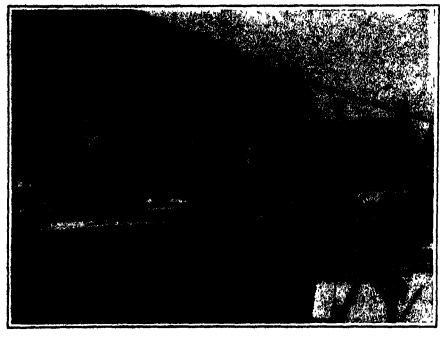


It utters fog warnings that can be heard thirty miles away.

Transporting Steel Boats from Cincinnati to Chicago

FIVE steel-hulled gasoline-motored boats that plied the waters of the Miami and Erie Canal, were purchased recently for service on the Great Chicago Drainage Canal. To get them to Chicago was a big task as the Miami and Erie Canal, before emptying into the Ohio River at Cincinnati, terminates in an underground stream on the outskirts of the city, and the transports were twenty squares away from the river. This necessitated their being taken from the canal and transported overland through the heart of Cincinnati's business district.

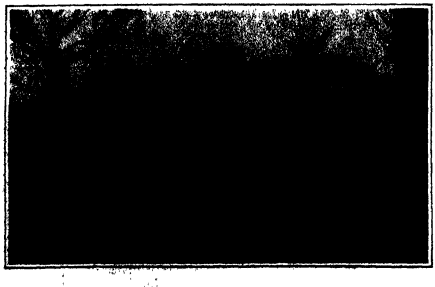
To get boats on trucks, a huge derrick was built over the canal and the transports were lifted from the water by means of pulleys and steel cables, then shifted over upon the trucks waiting on the canal banks. As each of these transports weighs 20 tons and is 150 feet long and 25 feet wide, it required two days to place each of them upon the trucks and another day to haul it the twenty squares to the river. The five boats were then made seaworthy preparatory to beginning their 1,200-mile voyage down the Ohio, into the Mississippi, up the Mississippi and Illinois rivers to the Great Chicago Drainage Canal port.



How the steel boats were lifted from the canal and placed upon trucks.

Building Ceremonial in China

EXCEPT in treaty ports where the modern influence has made itself felt in such ways as street cars, modern buildings, etc., Chinese methods are much the same now as they were a thousand years ago. It has long been a ceremonial custom to pound the earth preparatory to erecting a new building. A ring of coolies, or foklas, each at the end of a rope which terminates in a large stone in the center, sway inward and outward, allowing the stone to rise and fall upon the ground. The work is accompanied by a weird singsong, and the whole procedure is considered as being propitious to the lives of those who will inhabit the structure which is to be built.



Pounding the earth for a Chinese building foundation.

The Telephone Nursemaid

PROBABLY the youngest child to habitually use a telephone is to be found at the present time in Guernsey, where a four months' old baby sleeps every fine day in the open air with a telephone transmitter at his side by which he calls his mother on awakening. Thus a problem is solved which has troubled many a busy mother who, having no nursemaid, cannot spare time to be constantly outside looking after baby and yet is not willing to deprive her child of the benefits gained by putting it to sleep in the open air.

Many a child, indeed, who strenuously refuses to sleep in the house quickly goes off to slumber when taken outside, thus showing a wisdom beyond its years. The baby here referred to belongs to the engineer in charge at Platte Fougère Lighthouse Station, who in order to allow his boy to benefit by the breezes blowing in from the Atlantic, contrived this method.

In the baby carriage is a cigar box containing the telephone transmitter and a small clock. Wires running up to the house, twenty yards away, enable the mother in the intervals of her work to listen for baby's cry. When working at the table and during meals it is easy to listen continuously.

The clock, although its use is not at first apparent, forms an essential part of the device, for the sound of its ticking provides the necessary proof that the telephone is transmitting sounds correctly. This method of employing the telephone as nursemaid has proved completely successful and is in daily use, while a rain alarm has also been evolved to give warning by causing an electric bell to ring should a shower come on.



Telephone extension of mother's ear.

Freaks in Baseball

FREAK plays make baseball humorous if not interesting. Some of these plays are said to be the result of quick thinking, but as a matter of fact, most of them are simply luck.

Curious things happen. A ball fell into a tin can, and it being impossible to get it out in time, can and all were thrown to the baseman. Another ball hit the end of a nail driven through the opposite side of a fence and could not be got down until all the runners scored.

A swift hit glances off the pitcher's hand, is snapped up by an infielder and thrown to first, putting the man out.

Red-hot liners or grounders sometimes hit the first or third base bag and glance away for singles or even two-baggers.

The shortest two-bagger known was when the ball grazed the bat, shot up a few feet, and fell in front of the plate. As the catcher reached for the twirling ball, it glanced from his glove and bounded back to the stand, and the batter made second easily.

A center fielder saw a hit in the way of the shortstop and walked about sixty feet in to move it out of the way, when he heard the crack of the bat and saw a hot ball coming straight at him. He could do nothing but try to catch it, and did to his surprise. But he was given credit by the crowd for being a great student of batters.—Arthur Macdonald in *American Physical Education Review.*

The Court Quotes Scripture.—Mr. Justice Robb of the Court of Appeals of the District of Columbia illuminates his decision in the case of Brown v. Campbell by quoting from the Scriptures as follows:

"No man, when he hath lighted a candle, putteth it in a secret place, neither under a bushel, but on a candlestick, that they which come in may see the light." (St. Luke xi:33.)

And goes on to say that the man who secretes his invention makes easier and plainer the path of no one, contributes nothing to the public, and that over and over it has been repeated that the object of the patent system is through protection to stimulate inventions, and inventors ought to understand that this is for the public good.

THE UNIVERSAL

AN EDUCATION OR A TECHNICAL TRAINING FOR ANYONE, ANYWHERE AND IN ALMOST ANY SUBJECT

IT IS not my purpose to offer any article or commodity for sale. What I am writing now to the intelligent American public has no commercial or financial end in view. One of the most remarkable educational and sociological institutions in the world's history has grown to international fame and power in our midst, and while multitudes of men have been benefited by it, the leaders of national thought and enterprise have so far failed to realize its importance as a national asset.

An institution that has become a big factor in enhancing industrial efficiency, that has increased the earning power of hundreds of thousands of men and has become a social and moral lever to innumerable families, is worthy of being understood.

Entirely free from the taint of charity, and without adding a mill of taxation to the over-burdened taxpayer, the International Correspondence Schools have succeeded in realizing many of the hopes and ideals of political economists and humanitarians. No thoughtful man should be willing to remain ignorant of the purpose, methods and achievements of this institution.

A Fruitful Humanitarian Impulse

The International Correspondence Schools had their birth in a humanitarian impulse. Twenty-five years ago, Mr. Thomas J. Foster, then proprietor and editor of *The Mining Herald*, of Shenandoah, Pennsylvania, was appalled by the number of mine tragedies in the anthracite coal regions. He believed they were due chiefly to ignorance on the part of the mine owners, superintendents and workmen. In order to furnish information to those engaged in the hazardous occupation of mining, Mr. Foster began a series of "Questions and Answers" in his paper At that time, the only practical textbooks on the subject were published in England, and by means of their contents Mr. Foster answered the questions that soon flooded his columns. It was quickly discovered that miners, mine foremen, and superintendents were willing to pay for a more extended course of study if such were available.



MR. THOMAS J. FOSTER

With the help of competent engineers, Mr. Foster prepared a course of correspondence instruction in coal mining, and his first group of students began serious work twenty-two years ago. That successful beginning stimulated not only the humanitarian but the educational confidence of the editor of *The Mining Herald*, and from that day to this Mr. Foster has been constantly adding new courses of correspondence instruction, until now the International Correspondence Schools offer 275 courses of study—a far greater number and variety than any university in the world.

Sound Educational Basis

If the International Correspondence Schools had been an ordinary educational institution, they could have adopted textbooks prepared by class-room experts; but it quickly developed that to teach by correspondence required an entirely new method The institutions that have tried to carry on instruction by mail based on the ordinary textbook have failed. The I. C. S. textbooks are designed to meet the need of the student studying at home. They take practically no previous knowledge for granted, they proceed by easy stages and lead the student forward by natural and carefully graded steps; they foresee and meet the difficulties of the student by copious explanations, demonstrations, and illustrations; they eliminate all irrelevant matter, giving only such instruction as is essential to the mastering of the subject; the lessons are in brief units so arranged that the student is relieved from overstrain.

These textbooks form a library of 250 volumes, and cost more than two million dollars ($2,000,000) to prepare. They are kept under constant revision, with a view to meeting the difficulties of the student and to convey the newest knowledge or the latest methods of application. The costs of preparing a few of the courses are here given: Architectural, $98,178.06; Civil Engineering, $88,887.19; Textiles, $76,532.09; Coal Mining, $74,075.06. This expenditure upon textbooks certainly points to a solid and permanent foundation for the International Correspondence Schools.

The value of these textbooks is attested by the fact that they have been purchased and are being used for classroom work or for reference purposes in 167 universities, colleges, government schools, institutes of technology and vocational schools in America. The University of California has just discarded its textbooks dealing with the strength of materials and has had the International Correspondence Schools instruction papers on that subject bound into volumes, and has adopted them exclusively for the use of its students. The U. S. Navy Department has ordered 15,000 I. C. S. pamphlet textbooks for use in the new naval shipboard schools. This is about one-fifth of what will be required when the schools are in full operation. Several of the largest industrial corporations of the country are using I. C. S. textbooks and instruction papers in the classes they have formed for the training of their apprentices and employes.

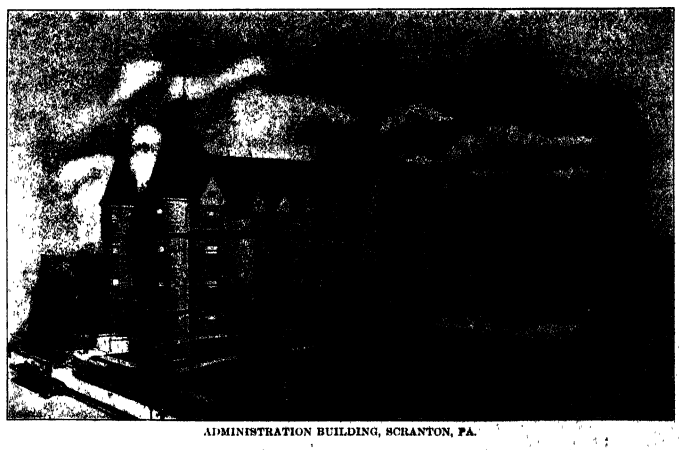
The Universal University

Has this outlay been justified? The answer is that the International Correspondence Schools have enrolled 1,651,765 students in the United States and Canada during the past twenty-two years, and are now enrolling new students at the rate of 100,000 a year. These figures are not given simply because they form an impressive total but for the reason that such an institution can only provide high-grade and efficient instruction when working on a large scale. For example, one of the courses of study—Electrotherapeutics—has a small enrolment because it is an advanced study for medical practitioners. The cost of conveying the instruction and correcting the papers results in a considerable loss each year to the institution. Salaries and overhead charges are just as great whether five or fifty papers are corrected per day. On the other hand, the Electrical Engineering Course has been taken by 224,188 students, and so it is possible to handle the students' work at the minimum cost.

In the place of classroom recitations, the student is required to send written answers to the School Examiners of the Instruction Department, the questions being designed to test the actual mastery of the subject by the student and cannot be answered by a mere formal copying of the text.

These papers are very carefully examined by the expert examiners, all errors are corrected, difficulties explained, and the principles and processes made clear if they seem obscure to the student. Marks are given for each grade of work, and no scholar is permitted to go on with his next lesson until the one upon which he is engaged is entirely satisfactory.

In order to prepare the student for serious work upon his course, he is required first to pass an examination upon a preliminary pamphlet, entitled "The Art of Study," in which he is taught how to study to the best advantage.



ADMINISTRATION BUILDING, SCRANTON, PA.

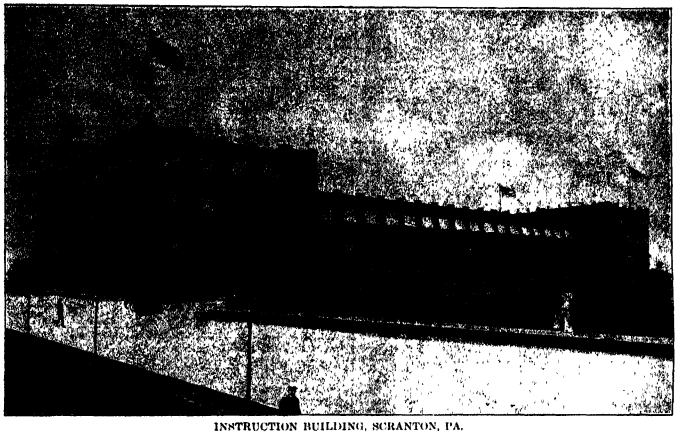
UNIVERSITY

BEING THE STORY OF HOW A HUMANITARIAN IMPULSE GREW INTO THE GREATEST TEACHING INSTITUTION ON EARTH

By JOSEPH H. ODELL, D.D.

Finding and Inspiring Students

While it may be acknowledged that advertising is one of the most important factors in modern life, it has been demonstrated that the International Correspondence Schools cannot secure enough students, even by means of the most elaborate and costly advertising, to insure the success of their enterprise, either upon humanitarian or commercial grounds. More than twenty years ago President Foster realized the force of Professor Huxley's statement: *"I conceive that two things are needful. On the one hand, a machinery for gathering information and providing instruction; on the other hand, a machinery for catching capable men wherever they are to be found, and turning them to account."*



INSTRUCTION BUILDING, SCRANTON, PA.

One of the chief differences between the regular college or university and the International Correspondence Schools lies in this: men who *want* an education *seek* the university, whereas the International Correspondence Schools *find* the men who *need* an education. No less than 1,346 agents of the Schools are scattered through the United States and Canada, whose one business it is to go into the homes, mills, factories and workshops to persuade men that they can be benefited by a course of instruction. These agents create ambition, stimulate hope, and preach self-reliance. They tell men, and they prove their point by innumerable examples, that they can make themselves more efficient in their present occupations or qualify themselves for other and more congenial and more remunerative occupations by a course of study at home and in their spare time. In this way they have personal interviews with tens of thousands of persons each week and the contact thus established results in inspiration and encouragement to multitudes who have lost hope in the hard battle for existence amid modern conditions. The International Correspondence Schools, as a part of their student enlistment work, also run instruction cars on a number of the most important railroads of the United States and Canada.

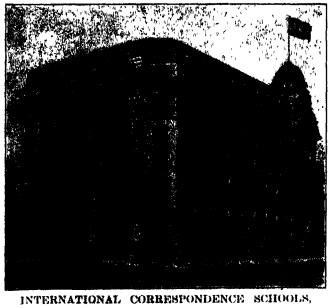
The cost of establishing and developing these agencies has been enormous, but the results have amply justified the investment from every standpoint. Up to the present the International Correspondence Schools have spent $1,703,965.20 in agency establishment, but the money thus invested must be regarded as necessary equipment just as much as the right of way cost of a railroad.

Keeping the Students Studying

No graver mistake can be made than to imagine that the International Correspondence Schools make a profit from lapsed students. Lapsing of students does not appreciably reduce the costs of the institution. As most of the enrolled students pay for their courses of instruction on the instalment plan, the profits of the enterprise come from the instalment payments of the students. A student will not continue to pay unless he continues to study, therefore it is the best business policy of the Schools to establish the study habit. Once a month, at least, the representative or agent of the Schools calls upon the student, not simply to collect the instalment due, but to offer encouragement, advice, and even assistance with his studies. This constant contact of the International Correspondence Schools with the student-body makes the institution a bona fide educational agency rather than a merely commercial enterprise, and insures a permanent future.

Indeed, no effort is spared to keep the student at his studies without intermission. Besides instructing the students in the most approved methods of acquiring knowledge prior to the first lesson of their course, and the periodic calls of the representative, a special department of encouragement and inspiration has been established by which sluggish or discouraged men are stimulated in their work. During the year 1913, no less than 805,079 individual letters were sent out to such persons, over and above 205,813 special letters dealing with particular difficulties encountered in the progress of their study. This resulted in an increase of 45 per cent. more study than was achieved before the department was put into force.

The International Correspondence Schools are faithfully, earnestly and persistently trying to convey instruction by every method known to pedagogy and psychology, and they are sparing no money in the effort.



INTERNATIONAL CORRESPONDENCE SCHOOLS, LONDON, ENGLAND

Do the Students Profit?

Beyond a doubt. Every day the evidence accumulates and can be placed before any one who wishes to investigate. The International Correspondence Schools recently published a book giving the life history of 1,000 of their students, in each case furnishing the reader with the name, address, and occupation of the example cited. These were simply a cross-section taken from 26,000 letters, voluntarily sent to the institution, gratefully acknowledging the benefits received from the instruction of the Schools. It is no exaggeration to state that every city and fair-sized town, and almost every village in America, can furnish examples of men who have been lifted by this one institution from penury to comparative affluence, from obscure drudgery to honor and influence, from the precarious ranks of unskilled and ill-paid labor to positions as skilled mechanics, foremen, superintendents, manufacturers, and men of large financial affairs. In fact many very successful and well-known heads of big industries, engineers, architects, and corporation managers have been International Correspondence students, and have reached their positions of eminence by means of the instruction and training provided by this institution

No one can possibly estimate the economic and social and moral part that the International Correspondence Schools have played in our complex national organism during the last two decades. Behind all statistics there are visions of a new and healthier and happier environment for multitudes of families.

World-Wide Extension

Fortunately, the International Correspondence Schools are on a firm financial foundation. They have done a gross business amounting to $85,753,140, and have distributed cash dividends amounting to $7,025,372, and stock dividends of $1,875,000. Besides this they own buildings valued at $1,159,286.39, copyrights and plates estimated to be worth $1,864,404.25, and behind it all a substantial surplus. This has enabled the International Correspondence Schools to become genuinely international. Added to their 3,400 employees in America, they have started a branch school in London which promises soon to rival its parent in this land. Already there is a staff of 400 instructors, textbook writers, and clerical employees in London, with 700 men engaged in selling scholarships in the British Isles. More than 100 men represent the I. C. S. in the British Colonies and the movement has the indorsement and co-operation of prominent English officials and educationalists. Branches are being organized in Central and Southern America, Mexico, France, Spain, and China, for which special textbooks are now being prepared

The Man Who Feels, Sees and Does

President Foster is a man of deep feeling, clear vision, and prompt action. From his office in the Administration Building in Scranton, Pennsylvania, he directs the energies of nearly 5,000 persons who are dedicated to conveying education and technical training to those who need it in any part of the world—even to the remotest corners of the earth, to places where the name of America is hardly known. He is pouring out thousands of tons of educational and inspirational literature every year, every page of which he hopes will open the door of opportunity to some one who now feels doomed to poverty and obscurity for the lack of adequate educational training. When men awaken to the facts and all of their far-reaching consequences in the advance of civilization and social progress, Thomas J. Foster, Founder and President of the International Correspondence Schools, will be hailed as one of the greatest and most honored of modern benefactors and educationalists.—*Advertisement.*



Does your Mirror say "Overwork?"

YOU know it does, but—the keener the brain the more unwilling it is to admit physical weakness. And yet you cannot escape the grim fact that overwork is undermining your system, weakening your nerves, upsetting digestion—driving you toward physical breakdown.

Now, there is a scientific food-tonic of which Arnold Bennett, the famous novelist, says that it has had a wonderful effect upon his nerves—of which Sir Gilbert Parker says that it feeds the nerves and gives fresh vigor to the overworked body and mind—of which Colonel Watterson says that without it he believes he could not have regained his vitality—from which scores of other famous people have received new strength, a greater capacity for work, a new joy in life.

That food tonic is Sanatogen. Over 21,000 physicians have written in terms of praise of Sanatogen's reconstructive help—think what that means! And frankly, is it not about time *you* gave Sanatogen a trial?

Sanatogen is sold by good druggists everywhere in three sizes from $1.00 up.

Send for Elbert Hubbard's new book—"Health in the Making." Written in his attractive manner and filled with his shrewd philosophy together with capital advice on Sanatogen, health and contentment. It is free.

Grand Prize, International Congress of Medicine, London, 1913

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The Martinsyde Transatlantic Challenger Monoplane

(*Concluded from page 24.*)

loaded, which was to have been sustained and impelled by the aerodynamic reaction of the planes and motive power against the air, and the force of gravity should have been close on to 5,000 pounds.

The tail was at the after end of the fuselage, and was of semi-circular form in plan, with a span of 21 feet. It had divided and balanced elevator flaps, and a balanced rudder of ample proportions.

It has already been mentioned that the machine was being constructed in duplicate, and it may be added that this duplication applied to the engine, since two separate, but identical engines had been put in hand, and both were to be sent to the starting point in Newfoundland, together with a very full supply of spare parts of the machine. Both engines were to be tuned up for the journey and one was to have been placed in the monoplane and the other kept in reserve as a measure of precaution, in the same manner as the duplicate wings and fuselage, etc.

Since the distance between Belle Isle Straits and the coast of Galway in Ireland is about sixteen hundred miles, and the aeroplane was expected to travel at 80 to 85 miles per hour, it was thought that the journey could be done in 20 hours during calm weather. A following wind would have materially increased the speed and shortened the time of the journey.

Eliminating a City's Filth and Flies

(*Concluded from page 29.*)

Knowing that he had no police authority, and that his only weapon was his power of persuasion, the junior sanitary policemen resorted to the use of polite notes, which were written or printed on a printing outfit that belonged to the neighborhood:

My Dear Mr ——————:

We are trying to make our school district flyless Will you help us? Flies breed in fermenting lawn clippings, open garbage, and stable manure, if it is not removed at least once a week We are writing this note to you because we are sure that you will help us.

Very truly yours,

——————,

Junior Sanitary Police.

The girls also appealed to the merchants through notes in the same way:

My Dear Mr. ——————.

Many people in our school district are refusing to buy food over which flies have crawled Can we help you to keep a flyless store this summer? Very sincerely yours,

——————,

Sanitary Aide.

Children took naturally to the work of cleaning their school district, for even boys and girls like to feel that their work is important. When conditions were met with which they could not cope, a plea for help written in a childish hand-writing and sent to the Street Cleaning Department was sure to bring assistance, whenever it was possible. Before the close of the school year streets were cleaned, alleys and vacant lots ceased to be dumping grounds for filth, and the rubbish from back yards gave way to gardens of flowers and vegetables.

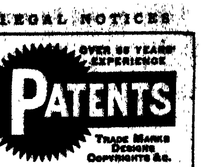
New Aeronautic Records

THE French military dirigible balloon "Adjutant Vincenot," piloted by Georges Joux and carrying eight passengers, has made a new world's record for continuous navigation by dirigibles. It remained in the air for 35 hours and 20 minutes

The German dirigible "Zeppelin L-3" established the previous record of 34 hours and 59 minutes in May in a flight from Friedrichshaffen to Berlin. The "L-3" measures more than 25,000 cubic meters; the "Adjutant Vincenot" 9,000 cubic meters.

The Germans still maintain the lead in aviation, particularly from the standpoint of duration. On the 28th ultimo Herr Landmann, with a 75 horse-power Albatross biplane, remained aloft, circling the Johannisthal aerodrome, for 21 hours and 49 minutes, thus adding well over three hours to the best previous record. He finally descended because of fatigue, and not from lack of fuel.

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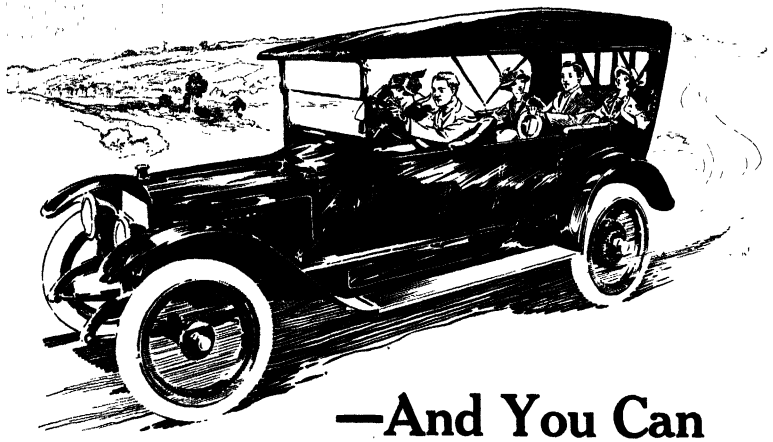
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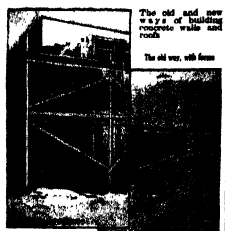
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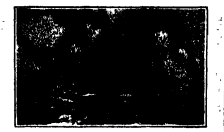
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Separate Running Gears and Bodies for Railway Cars

How One Inventor Meets the Increased Cost of Operating Trains

THE recent granting of a patent on railway cars for both freight and passenger service, issued under date of June 23rd, 1914, to James Harvey Wood, Jr., of New York city, discloses a proposed departure from present methods of car construction which has evidently been intended to meet the economic difficulties that confront the operation of great trunk lines.

The invention contemplates as a general principle of car construction, a railway car consisting of two separate and distinct units—a car carriage or running gear, and a car body. Any running gear of a given class, type or capacity may be used with any car body of a corresponding class, type or capacity. To this end these two units are so designed as to permit of the simple and quick removal of a car body from a running gear and of readily interchangeable usage of either with different running gears or with different bodies of the same respective types.

The running gear embodies trucks, draft member, couplings, and all equipment and appliances, including air-brakes, essential or incidental to the operation of the car as a train unit. Heating, lighting, and other equipment pertaining to the car body exclusively is attached to the body. Each unit will be designed for its particular functions. The car body will be designed for its load without the necessity of considering its strength in relation to its use as part of a train unit, as the running gear will be designed to meet that function. Therefore, the position of the car body, whether light or heavy, in the make-up of a train becomes of less consequence, since it is not a train resistance unit, and its running gear will be of proper and possibly standard strength for the various types or classes of running gear and respective bodies.

Without regard to the merit of the particular construction disclosed in this patent, the two unit or interchangeable running gear and body in railway car construction may afford a profitable solution of some of the most important and long-standing railway problems.

In general, a railroad may refuse to accept from another road a car that does not appear to be strong enough or in good enough repair to be operated over the receiving road with safety. In such a case the load is usually transferred to a car of the receiving road at the expense, including car rent, of the transmitting line.

In discussing the question many experts in car construction and operation, who attended the recent meeting of the Master Car Builders' Association at Atlantic City, took the position or expressed the opinion that no car of less than 80,000 pounds capacity should be accepted or operated in interchange, or in other words, through freight service, for the reason that most new car equipment is now being built of at least this capacity, and that cars of less strength, if operated with these heavier and stronger cars, become, through their comparative structural lightness and weakness, a source of constant repair, delays, and expense as well as of danger to property and life through the parting of trains or other accidents due to failure of equipment. It was brought out, on the other hand, that thousands of cars, many owned by private car lines, are in good condition and may be operated with safety and profit as originally designed, but not with the heavy modern cars which prohibit their use, thus practically wiping out the large capital investment in these cars. This argument was especially marked in relation to privately owned stock cars. Most of these cars are of a capacity of from 40,000 to 60,000 pounds, and it was mentioned that to impose a minimum capacity for interchange cars of 80,000 pounds, would be equivalent to confiscation of the property represented by these cattle cars.

As indicating the general misapprehension of the term "capacity," it may be stated that it is impossible to load more than about 25,000 pounds of cattle in these cattle cars of 40,000 to 80,000 pounds capacity.

There are over 2,000,000 freight cars and 50,000 passenger cars in use on United States railroads. Nearly all great freight movements on these railroads are in what might be termed "season freight," or in other words, freight originating at certain times or seasons of the year, such as the crops; wheat, cotton, fruit, and others, and much of this freight requires a car of a more or less special type, that is unsuitable for other kinds of freight service.

In the two-unit construction only the special bodies need be idle, while running gears are employed with other bodies for which the demand exists.

There would doubtless be little difficulty or delay, upon the part of railroads, in reaching a common agreement on strength requirements for running gears, as the heretofore unreconcilable differences of opinion appear to relate to elements of the car body as a receptacle, such as dimensions and construction features. Any car body of present construction could be made properly to engage and operate with a separate running gear of agreed standard strength and build.

In this case a cattle car body that could not be loaded with more than 25,000 pounds of cattle need not be built of a minimum capacity of 80,000 pounds, as has been advocated, since the running gear would meet the standard requirements while the body need merely possess the desired carrying capacity, with of course a proper margin of structural strength over the demands of its usage as designed.

A standard and separately constructed running gear would be of equal use to all railroads, when freight is available, and therefore syndicate ownership of running gears with separate, or individual, road ownership of car bodies adapted to engage and operate with these gears, but otherwise of a type desired by the respective roads, should prove a feasible and economical plan of joint ownership.

Passenger trains on the railroads of the United States traversed last year a total of over 580,000,000 miles or, under the arbitrary estimate of an average of five cars to each train, a passenger car mileage of over two billion nine hundred million miles. Likewise, under the arbitrary estimate of twenty cars to a train, the freight car mileage is indicated to have been over twelve billion miles, or a total car mileage roughly estimated at fifteen billion.

Again taking an arbitrary estimate of one cent as the average cost of hauling a weight of one ton one mile, it appears that the accomplishment of a saving, or reduction, of one ton in the average weight of all railroad cars, would mean an actual cash saving, based upon the above-stated arbitrary assumptions, of $150,000,000 a year to the railroads of the United States.

The Internal Combustion Motor in the Field of Aviation

THAT the heavier-than-air flying machine would have been possible without the internal combustion motor seems probable, to judge by Langley's efforts, which came so very near actual success. But it would have been a severe handicap had the Wright brothers and their successors not been able to profit by the development of the light-weight internal combustion motor in the automobile industry. The present status of the aeroplane motor, and a forecast of its future development, forms the subject of a comprehensive paper recently read by Howard Huntington, secretary of the Aero Club of America, before the New Haven meeting of the American Society of Mechanical Engineers. This paper, with numerous illustrations, is reproduced in full in this week's issue of our SUPPLEMENT.

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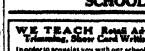
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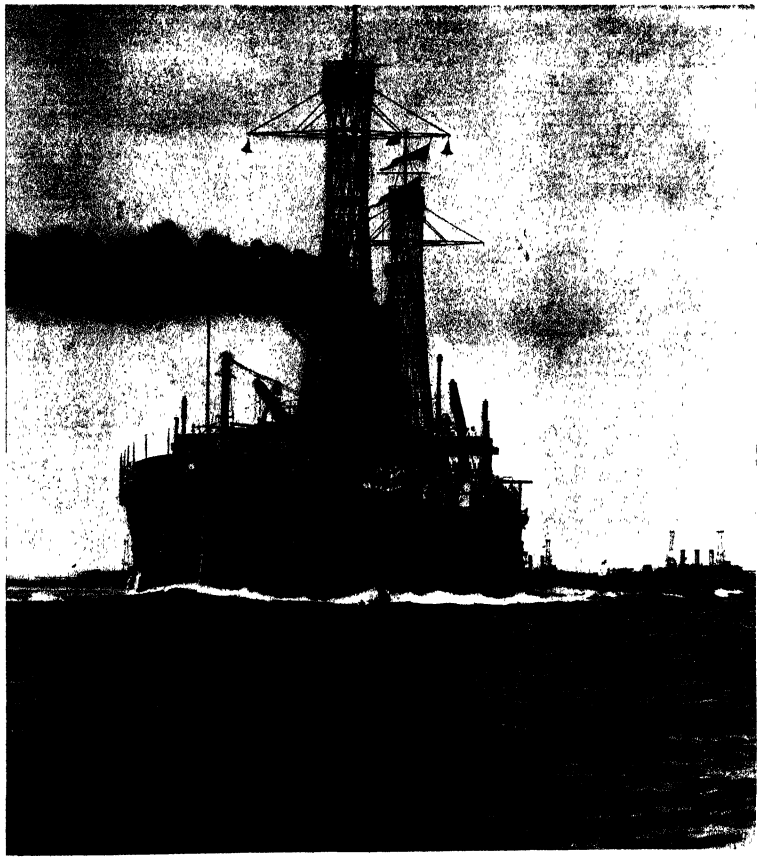


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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short* and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement

New York's Water Supply

WHEN the old Croton dam and aqueduct were opened, over half a century ago, it was believed that the new scheme of water supply for New York had been planned on such a generous scale, that the call for its increase would not come within the time of those who witnessed the opening of the fine municipal work. Little did the city government of that day realize how *rapid would be the growth* of New York *in size* and population, and how quickly it would outstrip every one of its municipal facilities, for not many decades passed before it was evident that a second and larger aqueduct must be built and additional dams must be placed in the Croton watershed, if the water supply was to keep pace with the ever-accelerating growth of the city's population. The completion of these additional works placed at the disposal of the city a maximum supply of not far short of 400,000,000 gallons of water per day.

Some ten or twelve years ago it began to be realized that the maximum supply of the Croton watershed through a period of dry seasons, even if every inch of rainfall were stored that could be gathered in the reservoirs, would be insufficient to protect the city against the peril of a water famine, and as the outcome of an intelligent agitation carried on at that time, New York city to-day can point to the stupendous scheme for an additional water supply, which is now nearing completion in the Catskill region, and throughout the 125 miles of distance covered by the Catskill Aqueduct between Ashokan reservoir and the southerly limits of New York. The inauguration of this work was one of the most commendable achievements of Mayor McClellan's administration.

Not a minute too soon was the construction of these great works undertaken; for at the present time New York is adding to its population at the rate of about 175,000 persons per year—*a rate of growth* which has never been approached in any city in the world.

The two aqueducts (old and new) bring into New York the waters of the Croton watershed, nearly 400,000,000 gallons per day, when they are both running to their maximum capacity, and when the whole of the Catskill watershed that will be tributary to the Catskill aqueduct has been developed, it will be possible to bring in an additional 500,000,000 *gallons of water* per day. How long this combined supply of nearly 900,000,000 gallons of water per day will suffice to meet the needs of the growing city, not even the most skilled student of the problem of this city's water supply can foretell; if the rate of the growth of the city should continue to increase as rapidly in the future as it has in the more immediate past, it will *not* be *many decades before the serious study* of the question of yet an additional water supply will have to be undertaken

Perfecting the "America's" Water Wings

THERE has been some inquiry as to what Mr Curtiss has been doing with the Rodman Wanamaker transatlantic flier since her formal launching and first successful flight, on June 23rd, previously described in the SCIENTIFIC AMERICAN. The answer is very simple; he has been trying the best methods of making her lift from the water as much weight as she can carry in the air. She has very efficient air wings, or members for lifting the bottom of the hull to a level with the water surface, making it skim the surface very swiftly, then clear the water entirely and soar through the air with minimum resistance.

The original "America" rose well *only* with a moderate load, and decidedly "wallowed" with her full weight of 5,000 pounds; that is, she plowed deeply and could not rise enough to skim. In fact, her bottom was too narrow for shallow draft, too narrow for very effective planing or skimming under full load. The bottom of the bow averaged about four feet in width, had to displace, together with the wing tip floats, 80 cubic feet of fresh water, and actually *sank about a foot and a* half when at rest. The problem was to find the best way to make the "America," under her own power, move fast enough along the water to enable her great wings to lift her bodily when totaling 5,000 pounds.

Two rival types of lifters, the buoyant and the unbuoyant, were proposed, and hurriedly put to proof. The buoyant lifters might be common hydroaeroplane floats placed under the biplane wings, or attached to the bow, or forming lateral excrescences of the bow. The unbuoyant lifters could be planing boards bearing on the water with their under surfaces only, or they could be solid little wing-shaped blades gliding at small angles underneath the water till they lifted to the surface, bearing with them the weight of the airboat not otherwise sustained by the upward pressure on the hull or its superstructure, the air wings and the tail.

The buoyant lifters were tried with such successive improvement as to satisfy Mr. Curtiss of their capacity to raise eventually the required load and probably more. First hollow protuberances were built along either side the bow, following its lower edge, and having a cross-section like a horizontal V. These exerted some buoyant lift and some dynamic lift under speed, but not enough of either. They were probably too narrow. Then ordinary flat Curtiss hydroaeroplane floats, turned up at the prow, were placed under each wing. They were, in fact, taken from the rehabilitated Langley aeroplane, nearby, and measured each 10 feet *long* by 3 feet broad and 6 inches thick. They buoyed sufficiently and planed well. The entire craft rose in the air several times with approximately the required total weight. Mr. Curtiss then thought to apply these floats at either side the bow, or to build out the sides of the bow to form such buoyant gliding surfaces. But he wished first to test the possibilities of hydroaeroplane blades, exerting only dynamic lift in the water, *and offering* much less head *resistance* in the air.

Accordingly he fixed to either side of the boat, flush with its under surface, firm wooden wings, each 6 feet long by 18 inches broad, flat below, cambered above, placed at a slight dihedral angle, and about under the center of lift of the air wings, to which they were trussed with stream-line posts and stay wires. Their angle of incidence was about the same as that of the *air wings*, and precisely the *same as that of the* bottom of the boat just before the step. These water wings were totally submerged at the start, but quickly lifted the craft till their tips rose out of the water. Then the lift fell off before the hull began to plane. Fourteen inches below these were then placed parallel wings extending from the keel outward 4½ feet to either side, and trussed to the boat's bottom and the first set of wings. They were flat below, cambered above and 10 inches wide. With this combination the whole boat, with five men and 500 pounds of supplies, was heaved bodily out of the water, about 6 inches, at a speed of less than 20 miles an hour. Naturally the air wings could not keep her out at this velocity, since her natural flying speed is 60 miles an hour. In the later experiments, which were halted on July 8th, a water wingiet about 18 inches long by 10 inches wide was fixed to the stern of the boat, while the main water blades of biplane form were placed shortly before the center of gravity, the combination thus giving a three-point support for purposes of automatic stability. When the last two runs were *over*, everyone was satisfied that this type of flying boat can be perfected to rise and glide on its blades at a true flying speed, and then take to the air on level wing. But it was thought best to postpone further experimentation of this sort, and to apply pontoons at once to the sides of the bow, in order to have the boat ready for shipment from Hammondsport by July 18th.

The hydro blades used by Mr. Curtiss, both those at the bow and the one at the stern, were fixed. Their angle of incidence could be changed equally by use of the air elevator, canting the whole boat fore and aft. Obviously all these blades can be pivoted and independently or conjunctively controlled as to their angles of incidence, as is done with the elevator and wings above them. Thus the craft can be made to glide on even keel at any speed, its unbuoyant dynamic water wings and elevator functioning in the familiar manner of those of an aeroplane, until a flying speed is attained and the craft leaves the water.

A Brobdingnagian Structure

NOW that the massive piers have been completed and the work of erection of the steel superstructure is under way, public interest will be quickened in the second attempt to span the broad St. Lawrence River with a cantilever bridge, which, in strength, weight, capacity, and length of span, will be the greatest structure of the kind in existence. That this second attempt will be successful there can be no doubt whatever. The failure of the first Quebec bridge, as was pointed out by this journal at the time of the disaster, was due to faults in design which were so glaringly evident, even to the lay mind, that it is a marvel that they should have found their way into a structure of that importance.

The main span between the piers is the longest in existence, measuring 1,800 feet. The second longest are to be found in the Forth Bridge, Scotland, where there are two spans, also cantilevers, each 1,710 feet in clear length. Following these come the great suspension bridges across the East River, New York, of which the longest is the Williamsburg span, of 1,600 feet, the old Brooklyn Bridge span being just 5 feet less in length.

It takes but a brief study of the main outline and principal details of the new Quebec bridge to be satisfied that the lessons of the failure of the old structure have been laid well to heart. Both in its skeleton outline and general proportions and in the detailed makeup of its members, the new bridge is a vastly better structure. It is designed to carry two railroad tracks loaded with the heaviest modern freight traffic and two footways. The live load for which the bridge is designed is 5,000 pounds per linear foot on both tracks for their full length with two of what are known as E-60 engines, both the train loads and the engines being so arranged on the bridge as to produce the maximum possible stresses. A wind load of 30 pounds on every square foot of the two trusses and a wind load of 300 pounds per linear foot on the exposed surface of the train was taken as the basis for determining the *wind stresses*.

With such wind and train loads assumed on a cantilever bridge of this magnitude, it can readily be understood that the sections of the various members have run up to enormous sizes. Thus to take care of the stresses in the upper chords of the cantilever, the section of the member next to the main post required no less than 32 eyebars, 2⅞ inches thick by 16 inches deep, having a total area of 1,120 square inches.

The greatest interest attaches to the lower chord members, for it will be borne in mind that it was the failure of the first panel of the lower chord, next to the pier, that caused the collapse of the earlier bridge. This member was about five feet square. In the new bridge the same member is 7 feet 2 inches deep by 10 feet 4 inches wide, it has a cross-section of 1,902 square inches, and its weight between panel points is about 400 tons. The member consists of four webs 7 feet in depth, each web consisting of four plates riveted together and having an aggregate thickness of 3⅝ inches.

It will be remembered that the bottom chord of the old bridge failed because of the absurdly light character of the latticing which was used to hold the webs in true axial line. This latticing, if we remember rightly, consisted of angles measuring only 3½ by 4 inches on the side. In the new bridge the webs of the corresponding member are tied together with 8½ by 8½ by 1 inch thick lattice bars at top and bottom, and by horizontal steel diaphragms, running through the whole length of the *member* at the mid-height of the webs. They are further held in place by transverse plate diaphragms disposed throughout the whole length of the member.

Even more impressive in size and weight is the main post of the cantilever over the pier. Built up of four separate cpitmns latticed together, it measures on the outside 9 feet by 10 feet. Its maximum cross-section is 1,903 square inches, and each post weighs no less than 1,500 tons. The shoe at the foot of each post is 19 feet high, 22 feet by 26 feet on the base, and weighs over 400 tons.

Throughout the whole bridge, whatever part of it may be considered, we find the same massive proportions. Thus, in the connections at the shoe on the main piers, above referred to, the main members, such as the bottom chord and the main post, bear upon pins, each of which is 30 inches in diameter and weighs over 6 tons. Again, the floor-beams, because of the great span between panel points, run to unprecedented dimensions. Generally, they are 10 feet in depth and each weighs about fifty-five tons. They are connected to the posts by 11-inch pins, which pass through the web of the floor beams (reinforced for this purpose) and through the posts.

Electricity

Telephone Bridge Across the Sea.—Press dispatches state that while giving evidence before the Dominion's Royal Commission recently, Godfrey Isaacs, of the American Marconi Company, declared that Mr. Marconi expects to establish wireless telephone communication between Carnarvon, Wales, and New York, as soon as certain mechanical details have been carried out at the former station, and he hopes that this will be done before the end of the year. So far, Mr. Marconi has made public no tests or experiments that would justify such a prediction.

Electric Railroad in the Tyrol.—The electric railroad known as Meberstacher Bahn is a short line of recent construction in South Tyrol, and it serves to connect the southern railroad station of Bozen, by way of Kaltern and St. Anthony, with the Mendelpass mountain incline, which starts at this latter place. Of 10 miles length with standard gage track, the line is operated entirely by adhesion, even though the maximum gradient is 6.2 per 100. A sub-station at Eppan, supplied by a power line, serves to furnish 1,200-volt continuous current for the electric road. Passenger and freight trains are drawn by motor cars carrying two electric motors of 100 horsepower each.

Recent Wireless Telephone Experiments in France have attained results that may have a far-reaching importance. With a transmitting station set up at Paris, long conversations are sent out and picked up at points over a hundred miles off. As explained in a recent note, the electric arc system of the officers Colin and Jeanci is used, working a 150-foot antenna. Ordinary wireless apparatus, such as even amateurs possess, will receive the spoken message. For instance, a small wireless station at Metitray, 120 miles from Paris, could receive long newspaper articles which were being read into the sending apparatus. More striking still was the use of a wireless telegraph motor car of usual make-up, with a 100-foot portable antenna mast which could be erected on the ground in 20 minutes. Conversation could be heard from Paris at a distance of 60 miles by a reporter of the *Matin*, from which journal we take our present account. Capt. Colin speaks of the great military use of the method. For instance, the general can send out orders direct by telephone to the field or to battleships. Tuning can be varied, so as to prevent interference.

A **"House Electrical"** will occupy a conspicuous place in the Manufacturers' Buildings at the Panama Pacific International Exposition. It will be the first model electrical home to be specially designed and built for the purpose by a skilled architect. It will be a full-sized house, of the attractive California-Spanish type, with electrical garage, workshop, creamery, etc., located nearby. Each room will be equipped with practical labor saving and comfort promoting devices operated by electricity. The kitchen, where most of the housework is accomplished, will be provided with an electric range for all cooking purposes, and with electrically driven machines for peeling vegetables, polishing silver, freezing ice-cream, driving cake and dough mixers, and doing other necessary work. In the electric laundry, the clothes will be washed by electric power, and ironed with electric flatirons. In striking contrast, the adjoining room will have an electric refrigerating plant of household size. The dining room will be arranged to show how light lunches and suppers can be cooked with the electric chafing dish, or the electric grill, on the table if desired. The garage will contain an electric runabout, battery charging outfit, etc. Adjoining the garage is to be located a small work-shop, completely equipped with electrically driven tools.

The Use of Electric Motors for operating water-supply plants by the use of piston pumps is on the increase, and in Germany there are already quite a number of examples of this practice. Among others, we may mention the Duisburg water works, which employ two Allgemeine 3-phase electric motors of 300 and 170 horse-power, arranged so as to be belted to the Borsig piston pump. Speeds are 242 and 144 revolutions per minute for the motors. Electric drive, by the use of these motors, is especially good for small town water works, and it is now found economical, besides having other advantages. At Strausberg, there is a small plant which uses a 21 horse-power continuous-current electric motor coupled by belt to a piston pump, and a larger plant lies at Erkner, using in this case a 100 horse-power Allgemeine electric motor of the 3-phase type running at 485 revolutions per minute. But for larger sized plants, the best practice is to use a slow-speed electric motor so as to be able to couple it direct on the pump shaft, and this method is adopted by the new plant of Spiesser-Muhlenthal. Each piston pump has a 150 horse-power 3-phase electric motor direct-coupled to its shaft, working at 5,000 volts. The new Wuhlheide works, which the city of Berlin is now operating by 3-phase current at 6,000 volts, are laid out on the same ideas. Here a single large electric motor has a pump on each end of the shaft, the motor thus lying between the two pumps. It is rated at 400 horse-power. Such a group is very compact. The speed is 73 revolutions per minute in this case.

Science

The "Carnegie," the non-magnetic yacht of the Carnegie Institution, left Brooklyn June 8th on another magnetic surveying cruise. This one is to last only six months, and is to be in northern waters, with calls at Hammerfest, Norway, and Reykjavik, Iceland.

A **Dental Research Laboratory** has been established at the Royal Dental Hospital in London, chiefly with the aid of a gift of £1,000 from Mrs. John Hampton Hale, whose late husband was chairman of the managing committee of the hospital.

Luminescence of Nitrogen.—It has been found that nitrogen, vigorously and spectroscopically pure, acquires a continuous luminescence, during the electric discharge, and therefore this phenomenon can no longer be attributed to the presence of traces of oxygen. In the presence of metallic vapors, such as those of mercury, sodium or potassium, the phenomenon is not produced owing to the nitrogen's being attacked by the metallic vapors, forming a combination of the metal with nitrogen. The presence of oxygen, which oxides the metallic vapors, hinders their action on the active nitrogen and renders its formation possible.

Fishes that Live at Great Depths.—The Prince of Monaco reports concerning his cruise made between July 22nd and October 10th, 1913, between the European and North American coasts Some most interesting studies were made of a series of specimens which inhabit a depth of over 3,000 feet in the ocean, and which come as near the surface as 300 feet, during the night only This fact is a most noteworthy one as regards physiology, for such specimens have a surprising faculty of supporting the enormous decompression which is due to this change of depth from a point of high pressure to one of low pressure, this being done at such frequent intervals, also the recompression when again descending.

Antarctic Journalism.—A London publisher is preparing to issue a lithographic reproduction, in facsimile, of the typewritten illustrated magazine with the production of which the members of the British Antarctic Expedition of 1910-1913 whiled away the southern winter of 1911. It is known as "The South Polar Times, Vol. III," its predecessors, volumes one and two, having been the work of Capt Scott's earlier expedition, and having also been reproduced in facsimile. The editor of the latest volume was Apsley Cherry-Garrard. The leader and most of the staff contributed articles; while colored illustrations, silhouettes, caricatures and photographs were supplied by Dr. Wilson, Commander Evans, B. C. Day, D. G. Lillie, and H. G. Ponting.

Classified Lists of Government Publications.—The practice inaugurated a few years ago by the Superintendent of Documents, at Washington, of issuing separate classified price lists of the publications offered for sale by his office has been continued and developed, until upward of fifty of these useful bibliographies are now available. Most of them have been issued in numerous editions, and thus kept up-to-date. Selecting a few of these lists at random, we find that they deal with such varied subjects as "Food and Diet," "Fishes," "Indians," "Geography and Explorations," "Plant Life," "Mines and Mining," "Alaska," etc Each pamphlet contains the titles of hundreds of government publications, grouped under appropriate sub-headings, which are arranged alphabetically.

An **Instrument for Measuring Turbidity** in liquids, gases, and solid plates—i. e., a "turbidimeter"—has been devised by P. V. Wells, of the U S. Bureau of Standards. A collimated beam from an intense source of light passes through a variable thickness of the turbid medium, and is totally reflected by a prism, thence forming a uniform beam in one field of a photometer The diffracted light is not totally reflected, but is refracted by the prism into the other aperture of the photometer. Thus the reading of the instrument is a function of the ratio of the intensities of the light scattered and transmitted, which, in turn, varies with the turbidity. A form of this instrument is to be used in the measurement of fog density, in connection with the International Ice Patrol. It seems likely to prove more useful than any of the other existing forms of fog-gage.

An Oceanographical Institute in Edinburgh.—At a meeting held May 25th in the rooms of the Royal Society of Edinburgh, plans were made for a National Oceanographical Institute to be established in Edinburgh as a memorial to the late Sir John Murray. Edinburgh is already the principal center of oceanographic research in Great Britain, as it is the site of two important laboratories of oceanography; one established by Murray in 1876, on his return from the "Challenger" expedition, and the other founded twenty-one years later by Dr. W. S. Bruce. The "Challenger" office contains the finest collection of deep-sea deposits in the world, while Dr. Bruce's laboratory is especially rich in polar marine fauna, notably in abyssmal forms. It is proposed to combine these collections and affiliate them with the University of Edinburgh, and also to establish a lectureship in oceanography in the university.

Aeronautics

Shutters in Planes.—In a patent, No. 1,099,146, George C. Beidler, of Rochester, N. Y., shows an aeroplane whose planes are provided with automatically controlled shutters for aiding in stabilizing the machine.

Another Safety Device for Airships.—Thomas A. T. Yerness, of Chicago, Ill., in a patent, No. 1,100,277, provides means to be applied to an airship to prevent it from falling too rapidly in case of accident, or if the operator should lose control of the machine.

Orville Wright's Proposed Retirement.—It is announced in the daily press that Orville Wright has expressed a desire to withdraw from the active business management of the Wright Company and to confine his attention to actual inventing and engineering. The Wright Company will probably be reorganized.

Disappearing Running Gear for Aeroplanes.—Frank McCarroll, of Dallas, Tex., has secured a patent, No 1,097,816, providing a running gear for aeroplanes which can be disposed out of sight and out of the plane of movement of aeroplanes after the machines have risen from the ground. Thus he reduces air resistance in flight.

A **Governor for Aeroplanes.**—Ray E. Kellog, of Los Angeles, Cal., in a patent, No. 1,097,645, provides for controlling and regulating the pitch or angle of propeller blades in accordance with the speed of flight, so that the air pressure upon the propeller blades will be equalized in proportion to the centrifugal force.

A **First-aid Package** is hereafter to be included in the equipment of every aeroplane belonging to the German army It will be placed behind the seat of the pilot, and marked with a conspicuous red cross, so as to be readily found by the first person to reach the scene of an accident

A **Pendulum Aeroplane Control.**—In patent No 1,098,098, James V. Crowthers, of Philadelphia, seeks automatically to control the movement of the warping plane, aileron or other movable part, by a suspended gravity controlled weight which co-operates with such parts in forming an equilibrator.

A **Stabilizer Which Eliminates the Drag.**—Martin L Kors, of Chicago, Ill, in a patent No. 1,098,735, provides a stabilizer and other controlling means for aeroplanes, the purpose of which is to supply a stabilizing device which eliminates the drag occasioned by the warping and the augmentation of stress in time of danger from tipping

Aeroplane Pendulum Balance.—Henry Morse, of New York city, in a patent, No. 1,099,508, provides in connection with an aeroplane an automatically acting balance means, applicable to any type of aerial vehicle, and under control of the operator so it may be brought into operative position and moved out of such position at will

Propellers that Direct Air Under the Wings.—In a patent, No 1,098,024, Adalbert Domaradzki, of Cleveland, O., presents a flying machine having wings and propellers which direct air under the wings to aid in buoyancy and flight. The idea is not in accord with the best teaching on the subject, for obviously the planes are constrained to travel in disturbed air.

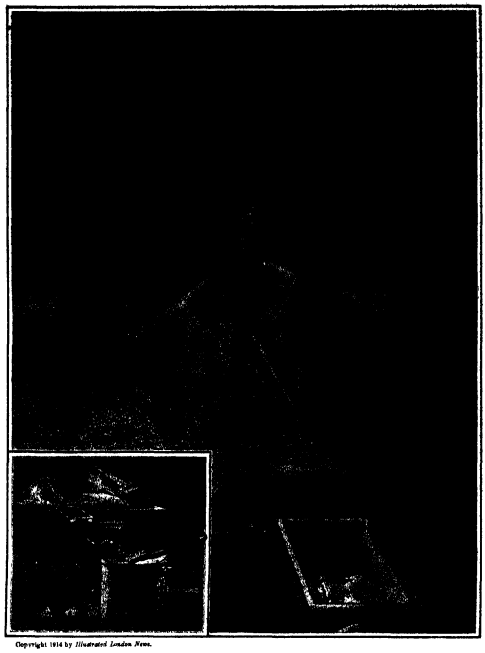
The Navy Aviation School.—A course of instruction for air pilots and one for mechanicians has been approved by Secretary Daniels, and a class of officers and enlisted men will be detailed to take the courses preparatory to the "air service of the sea" A post-graduate course will be provided for promising students, who may be sent abroad or to technical schools in this country.

A **Knock-Down Aeroplane.**—Patent No. 1,099,762 to Henri Hubert Pagny, Rheims, France, assignor to Société Anonyme des Appareils d'Aviation Hanriot, Rheims, France, is for an aeroplane in which it is claimed the taking down and refitting of the apparatus may be effected rapidly even by unskilled labor, since there is no need to adjust or regulate any part, and the majority of parts subject to deterioration can be changed in a very short time and with ease

An **Official Test of French Aeronautic Motors.**—The French War Department has decided to hold an important concourse of aircraft motors, and this event will probably take place early next year. The main lines of the regulations are already drawn up, and the tests will be made upon three classes of motors, namely, small, medium and high power. All constructors will be admitted to the event, including specialists in rotative motor building and the constructors of fixed motors in star or upright designs. It is expected that the concourse will bring out a number of new types of motors, the rules of the contest being of a nature to promote such new forms. The Automobile Club will co-operate in organizing the event and in carrying out the tests, and these will have a different character from the usual testing-bench trials, for it is intended to mount the motors on automobiles with aerial helices, or upon hydroaeroplanes or water gliders Tests will be held on various lakes, and the motors will make a continuous run from 5 to 12 o'clock, making variations at the carburetor and other points.

The Mechanism of a Volcano

MR. C. J. WOODWARD has designed a piece of apparatus to illustrate the formation of volcanic cones when the ejected materials are of a fragmentary character, i. e., the "cinder cones," characteristic of explosive eruptions. This consists of a large square table which is perforated in the center and below which is fixed a vertical tube, connected at the farther end with an elastic tube, leading to a pair of bellows. The latter is worked by a handle, and sends a continuous vertical blast of air up from the table. Into the side of the tube near its point of emergence in the table is fixed another horizontal tube, filled with sawdust which is supplied from an open box at the side of the table from which the tube leads and is continuously pushed forward by means of an endless screw, which is turned by a handle at the end. In this way a vertical shower of sawdust is ejected from the pipe, after the manner in which fragmentary material is ejected from the vent of a volcano. The manner in which the material collects round the vent is thus demonstrated, and by continuing the process with variously colored sawdusts, a cone with central crater, showing the peculiarities of a volcanic cinder cone, is gradually built up. The internal structure of such a cone is here demonstrated by fixing two vertical sheets of glass in a radial direction before commencing operations, and at the end removing all the sawdust which lies between them. In this way the inward slope of the deposit within the crater and the outward slope in the flanks of the cone are fully demonstrated. The proportionate height of the cone depends on the angle of repose of volcanic fragments in one case, and of sawdust in the other, but these are not very different, hence the natural slope of such cones is fairly well shown.



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Model of a volcano, drawn by the "Illustrated London News," from a design prepared by C. J. Woodward. The model is based upon the explanation of volcanic action to be found in Judd's "Volcanoes."

In the accompanying picture, which we are able to reproduce by courtesy of the *Illustrated London News*, the summit of the cone is unsymmetrical; this may be imagined to be due to a draft of air at the time of the experiment, and illustrates the effect which a wind may have in modifying the shape of a real volcano in process of formation. The slope of the cone also shows a characteristic curve, which has been the subject of several investigations by Milne and others. The curvature is approximately logarithmic, and is due to several causes. One is impressed by the general resemblance of the volcano's outline to the "probability curve," which might be expected to result from the greater chance of cinders falling near the crater than at a distance from it. A more important factor, however, in determining the actual shape of a cinder cone is probably the size and weight of the ejecta; the larger particles tend to roll farther down the slope than the smaller, because their descent is less retarded by friction in proportion to their weight. Again, the tendency of a self-supporting heap under the influence of its own weight is to spread out at the base, this also tends to give a logarithmic curve to the slope. Milne has suggested that the Japanese modeled the curved roofs of their houses after the volcanic cones which are so familiar in Japanese landscapes.

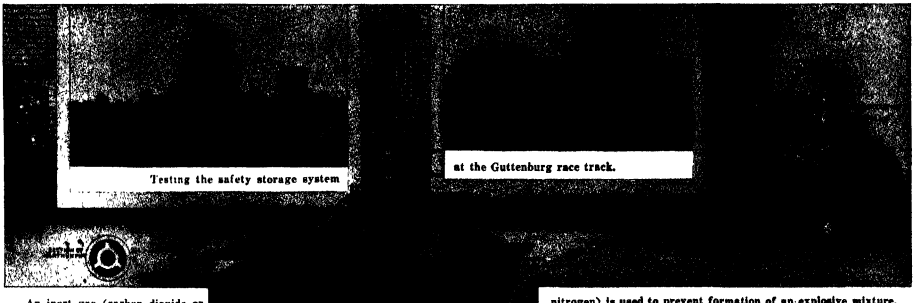
A small electric lamp with a red bulb might, perhaps, be installed in the orifice of the vertical tube. Then if the experiment were performed in a darkened room we should have a realistic reproduction of the apparent flames of a volcano in action, which are in reality merely the reflection of the glowing lava in the crater upon the ascending column of steam and dust.

Testing a Safety System for Storing and Distributing Inflammable Liquids

By Herbert T. Wade

THE storage of gasoline and other inflammable liquids used for internal combustion motors and various industrial purposes, presents many serious hazards, especially in congested cities where the extensive use of motor vehicles requires the storage of a large supply of fuel at garages and distributing stations. Such conditions naturally are a source of danger and worry to fire departments and insurance officials. Despite stringent regulations, which may or may not be observed, even with the best of appliances the danger is as real as it is apparent, and, accordingly, much interest attaches to any method that will tend to minimize the risk not only to the premises in which the inflammable substance is stored, but to surrounding property.

Such a method has been developed in Germany, and after some eight years of thorough test and wide application, it has found extensive use, especially at central stations and garages, where a large number of motor buses or other motor-propelled vehicles are housed, and in the dry cleaning and similar establishments where large quantities of naphtha or other inflammable liquids are used for industrial purposes as well as in the battleships of the German navy for the protection of inflammable liquids. This system, developed in Europe by Martini & Hüneke, is now beginning to find application in the United States. A public demonstration was given on June 30th, which was witnessed by fire and insurance officials as well as by engineers, and others interested, including officers of the United States Army and Navy, at which the success and usefulness of the new method were shown. The success of the protection of gasoline in storage, and as used about a garage, was most apparent, and the spectators were able to witness such striking evidence as an ordinary transportation drum subjected to a fierce fire while delivering gasoline to



Testing the safety storage system at the Guttenburg race track.

An inert gas (carbon dioxide or nitrogen) is used to prevent formation of an explosive mixture.

the storage tank of the system. Some 250 gallons of gasoline in the storage tank itself were exposed to electric sparks of a voltage of 10,000 to 15,000 volts, which under ordinary circumstances would have served instantly to ignite the vapor and explode the contents. Supplementing these tests, and furnishing a most striking spectacle, was the ignition of the gasoline from the storage tank issuing from the draw-off valve discharging to its full capacity without danger to the storage tank and its contents.

(Concluded on page 49.)

The Paul Schmitt Biplane

By John Jay Ide

THE alteration of incidence with its complement power variation has long been considered the ideal method of attacking the problem of varying speed in flight. The variation of incidence has also other advantages. It allows the aeroplane to take a horizontal, upward or downward course while keeping the fuselage absolutely level; the maximum efficiency can always be preserved whatever be the variations in useful load and motor power; the machine can rise after a very short run with the tail high, a most valuable feature for hydroaeroplanes; and finally the wings can be made to exercise a very considerable braking power.

For four years Paul Schmitt has been trying to devise a satisfactory means of varying incidence. That he has finally succeeded in evolving a good system is proved by the recent sensational performances of the machine bearing his name. He won the second prize in the recent safety contest for aeroplanes held in France.

The fuselage is made up entirely of steel tubes autogenously welded. This system of construction has many opponents, but if well carried out, as in this case, should give entire satisfaction. The section is quadrangular from the bow to the rear of the seats. Thence the two lower body spars converge until, at a point about two thirds of the entire distance from front to rear, the body becomes triangular in section. At the extreme stern the lower spars divide again and rise slightly, joining the upper spars, which are parallel throughout. This facilitates attaching the elevator. The lower spars also rise slightly toward the bow, thus reducing head resistance. The motor, a 160 horsepower Gnôme carried between two bearers, is covered by a shield on Morane-Saulnier lines and drives a Chauvière tractor. Behind the tanks are the cockpits for passengers and pilot. The top of the fuselage is stream-lined, and the whole is covered with fabric.

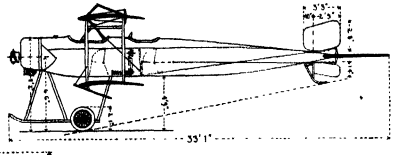
We now come to the most interesting part of the whole machine: the means for varying the incidence. The two planes rotate about a transverse horizontal axis placed rather high up between the planes, and about one-quarter of the distance from leading to trailing edge. This axis is a tube swung by ball-bearings on a pair of inverted V stanchions braced at their lower ends to upper fuselage longitudinals. The extremities of the axis are rigidly attached to two deep section oval tubes placed fore and aft between the front and rear upright of the central cellule. The four uprights pass through the fuselage and are joined together at the bottom by steel tubes. They are connected in similar fashion at the top, but in this case the tubes are concealed by the wing section.

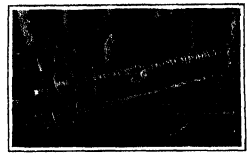
From the above description it will be seen that the central cellule could rotate freely around the axis until the interplane struts finally came in contact with members of the fuselage. In order to control pivoting of the planes a strong threaded shaft borne on ball-bearings is attached in a longitudinal position to the bottom of the fuselage. The shaft is prolonged behind the rear bearing and terminates in two concentric sprockets connected by chains to two wheels, likewise concentric, controlled by the pilot. Rotating the large pinion causes the shaft to revolve slowly, the small one causes a more rapid movement. On the shaft is mounted a large nut which is displaced forward or aft by turning the shaft to left or right. This nut is connected by two pivots to the rear uprights of the cellule. Movement of the nut, therefore, causes the cellule and the planes to which the cellule is attached to swing through an arc of from 0 to 12 degrees. The amount of rotation can be controlled within the smallest limits by the two handwheels.



The landing gear is remarkably strong.

Note the plane-pivoting mechanism





Threaded shaft with nut controlling the variation of incidence.

The Paul Schmitt biplane in flight.

The planes are divided into two parts each assembling into the central cellule. In all there are sixteen interplane struts suitably cross-braced in order to give sufficient rigidity to what constitutes a girder of fifty-seven feet span. The struts are profiled so as to give the minimum of wind resistance. Large ailerons are fitted to the rear of the upper plane. The elevator is very large, forming the entire tail-plane. It is of the non-lifting type, i. e., perfectly flat, and can be swung through a comparatively large arc, thus aiding considerably the incidence variation of the main planes. There are two rudders, one above and one below the elevator. The rudders and elevator are, like the fuselage, composed of steel tubes covered with fabric.

The landing carriage is made up of two reinforced skids joined to the body by six struts diagonally braced. An axle slung from the skids by rubber shock absorbers carries four wheels. The strength of this construction is incontestable. A small skid is fitted at each extremity of the lower plane to take up the shock produced by a bad landing. There is also a skid placed below the rear of the fuselage to protect the tail plane and rudder.

The leading characteristics of the machine are as follows:

Upper span	57 feet 6 inches
Lower span	44 feet 6 inches
Length	33 feet 1 inch
Surface	484 square feet
Weight (empty)	1,430 pounds
Maximum speed	68 miles per hour
Minimum speed	22 miles per hour

The machine can start or land in an inclosure 400 feet long surrounded by a fence six feet high the maximum distance required for taking flight or alighting being under 300 feet.

Early in March at Chartres Garaix began a wonderful series of height records, some of which were snatched away from him by Illner and Theien, only to be recaptured by the pilot of the Paul Schmitt. On March 28th he established a record of 1,580 meters (5,182.4 feet) carrying eight passengers, 150 liters (33 gallons) of gasoline and 40 liters (8.8 gallons) of oil, making a total useful load of 758 kilogrammes (1,667.6 pounds). The record height was reached in 44 minutes, giving a vertical speed of over 35 meters (115 feet) per minute.

On March 31st Garaix established a final record of 1,590 meters (5,215.2 feet) with nine passengers. The same amount of gasoline and oil was taken as previously, the total useful load becoming 823 kilogrammes (1,812.6 pounds). The flight lasted 68 minutes, of which 59 were spent in climbing.

The Paul Schmitt now holds the following world's records for height:

Passengers	Meters	Feet
4	3,150	(10,332)
5	2,250	(7,380)
6	1,750	(6,740)
7	1,600	(5,248)
8	1,580	(5,182.4)
9	1,590	(5,215.2)

The most wonderful flight of all, however, was made on the 22nd of April, when Garaix, carrying six passengers, broke twenty-seven records of speed, distance, and duration with two, three, and four passengers and created eleven new records. The 10-kilometer circuit was covered eleven times, making a total of 110 kilometers (68.2 miles) in 1 hour 2 minutes 25⅘ seconds. The total load was 620 kilogrammes (1,364 pounds), of which 405 were the pilot and passengers, 10 ballast, 105 gasoline, and 40 oil.

The new records established are given below, with speed, pilot, and six passengers: 10 kilometers (6.2 miles), 5 minutes 35 seconds; 20 kilometers (12.4 miles), 11 minutes 12⅘ seconds; 30 kilometers (18.6 miles), 16 feet 48⅘ seconds; 40 kilometers (24.8 miles), 22 minutes 28⅘ seconds; 50 kilometers (31 miles), 28 minutes 5⅘ seconds; 100 kilometers (62 miles), 56

minutes 44 seconds. Distance in one half hour: 50 kilometers (31 miles). Distance in one hour: 104.141 kilometers (64.6 miles). Greatest speed: 107.462 kilometers (66.6 miles) per hour. Duration: 1 hour 2 minutes 25⅘ seconds. Total distance: 110 kilometers (68.2 miles).

When Garaix established his height record for six passengers with 1,750 meters (5,740 feet) in 27 minutes he employed an angle of incidence of 7 degrees, while in his records of April 22nd, he used an angle of 1½ degree. The practical utility of the apparatus is thus seen at a glance.

The New British "Mark R. E." Biplane

By Major H. Bannerman-Phillips

THE aeroplane known officially as the "Mark R. E." biplane is the product of the Royal Aircraft Factory, Great Britain. At the Wilbur Wright memorial banquet in London on the 19th of May last, Colonel Seely, late Secretary of State for War, referred to this machine when he said, in responding to the toast of "Flying," that in his judgment the problem of stability of the aeroplane had been solved, since on the previous Friday he had taken part in a demonstration in which at the height of 2,000 feet the pilot abandoned all control, and he himself steered the machine about. There was a 28-mile an hour wind blowing when the experiment came off and the machine took the right banking and resumed its level flight. It is a tractor-biplane with four-bladed propeller. The engine used with it is a 120 horse-power Beardmore-Austro-Daimler. The letters "R.E." stand for "Reconnaissance-Experimental," and the machine is considered good even outside of government circles, which in regard to the flying machines of the Royal Aircraft Factory is not always the case. It is a modification of another well-known machine turned out by the Royal Aircraft Factory, the "B.E." or "Blériot-Experimental," of which a number are in use in the British air service. The question of publishing some of the aero-dynamical features of the construction has not been decided at present, but the military features will naturally be kept secret as long as possible, since the public interest demands it. It is, however, *inherently stable and does not owe* its self-balancing properties to any automatic control machinery. The object of providing for stability is not that it may be easier for an indifferent pilot to manage the machine, but in order that during the ever-increasing length and duration of flights for purposes of *military reconnaissance* the strain of constant balancing and control may be reduced to the lowest possible limits, and the pilot's energies economized to that extent, while at the same time, if he is required to do double duty as both pilot and observer, through casualty in war-time, he may be able to do so more easily than in a machine which requires greater continuous attention on the part of the pilot.

It may be observed here that the question of automatic or inherent stability is not so important in machines flown at considerable height, since the experiments of Pégoud and the imitation of his feats by others, in addition to sundry involuntary experiences on the part of sane airmen preceding Pégoud's attempts, have shown that, given sufficient room vertically, an aeroplane can be overturned and righted again without coming to earth by the efforts of the pilot. On the other hand, the close attention demanded of the aviator by a purely hand-controlled flying machine which is not inherently stable is very great during a long journey, and he is liable to be taken off his guard by a wind-gust occurring during a comparatively calm voyage, whether over land or sea. At the same time it must be remembered that the self-balancing aeroplane, so called, whether it owes its steadiness or stability to design and construction, as in the Dunne machines, or to automatic control, as when fitted with the Doutre stabilizers, has the defects of its self-righting qualities in that when the pilot does exercise full control, as for instance in turning or landing, it is apt to be sluggish in answering to that control, which under certain circumstances may be awkward and even dangerous. For instance, at maneuvers in Great Britain quite recently an officer of the Royal Flying Corps, who had chosen his landing-place and was coming down, suddenly became aware of a squadron of cavalry, who, in the course of a sham fight, were emerging from cover and charging across the open ground he had selected. By a supreme effort of skill and judgment he managed to avoid them, but one shudders to think of the havoc his machine would have caused if through want of skill on his part or slowness of the aeroplane in answering to the controls, it had been driven in among men and horses.

According to the London *Times* the King, the Queen, and Princess Mary recently paid a visit to the Royal Aircraft Factory and witnessed a flight by the "R.E." The passenger was Major Clive Wigram, Assistant Secretary and Equerry to the King, who was taken a flight of about 10 minutes without either controls, elevator, or rudder being touched.

Although the manner in which stability is maintained has not yet been made public, the *Times* ventures the following explanation:

"It is believed that in the present instance the rudder is spring-controlled, but that all other movements are due to the inherent stability of the design, which, expressed in other words, is this: A righting couple is formed, tending to restore balance when by any means balance is disturbed, and, in addition to this, if the flight path is disturbed, any oscillation which is set up is of the kind which dwindles down to nothing. If an aeroplane is stable laterally it must also be stable directionally, since the two are inextricably linked, but they may be considered separately to some extent. Any loss of lateral balance involves side-slip, and therefore side-slip is utilized to create the restoring couple. Side-slip produces a side wind on the "fin" surfaces of the aeroplane. These are made up of the lateral surfaces of the struts, wires, wheels, the fuselage, the propeller, and in addition there is a fin equivalent obtained from the dihedral angle between the wings. On all these surfaces the side wind acts, and if they are exactly proportioned there is enough top fin to give the righting moment. So far this has long been known and practised by aeroplane builders, but it does not give the stable aeroplane, as we may see by carrying the analysis a little farther. When the side-slip begins the whole aeroplane moves sideways relatively to the air, consequently the fin forward and the fin aft must be exactly balanced

"If, as has so frequently been the case in the past, the fin near the rudder is too large, the side wind up it tends to throw the stern round, and, in the absence of the pilot's correcting action on the rudder, the machine "nose-dives." Conversely, with too small a fin aft, the same trouble arises in a different set of circumstances and produces the same awkward results.

"It is precisely in the calculation of the fin aft in relation to the fin forward that the directional stability so closely affects the lateral stability, and this linkage has, it is hoped, been made broadly evident by the above example.

"In longitudinal stability the difficulty is quite different. Longitudinally there are oscillations of the aeroplane on its center of gravity regarded as pivot, and there are oscillations of the whole mass on its path, both classes of oscillations must tend to die out.

"A matter of extreme importance in this connection is the alteration in the lifting force exerted by the wings. Unfortunately, when a dive begins, the center of lift of the wings tends to move backward toward their trailing edge, and this obviously aggravates the dive by lifting up the tail and depriving the front edge of the wings of their quantum of lift.

"To remedy this and to damp out oscillation is the function of the tail. Those machines which depend entirely on the pilot's sense of balance also depend entirely upon him to check the oscillations by appropriate movements of the elevator. Many an argument has taken place between those who, to give the pilot greater control, insisted upon the whole of the tail being mobile, and certain authorities who insisted that the damping effect on oscillations of the fixed portion of the tail was of priceless value to the pilot by giving him time to act. This point of view has to-day obtained far greater force in that the fixed-tail plane, if appropriately designed, can not only damp oscillation, but actually introduce the corrective moment necessary."

Business in the Patent Office

THE issue of patents on July 14th, 1914, appears to be the largest in the history of the Patent Office, and will include 907 mechanical patents and 23 design patents. During the past three months the receipts of the Patent Office have broken the record, the receipts for April, 1914, being $208,905.64; for May, $193,723.24; and for June, $198,508.79; or a total for the quarter of $601,137.67.

A comparison of the applications received in 1913 and 1914 of the Patent Office shows as follows:

Applications received during the fiscal year ended June 30th.	1913.	1914.
Applications for patents for inventions	67,986	69,311
Applications for patents for designs	1,930	2,441
Applications for reissues of patents	172	189
Applications for registration of trade-marks	7,053	8,146
Applications for registration of labels	926	1,016
Applications for registration of prints	844	430
Disclaimers	22	20
Appeals on the merits	1,051	1,696
Total applications, disclaimers and appeals	80,084	83,225

Autographic Kodak

THE latest invention in cameras is the autographic kodak, the conception of H. J. Gaisman, who also invented the auto-strop razor.

Heretofore, to keep a record of pictures has meant that the films must be marked in some way after they have been finished, or the prints must be marked.

With the autographic kodak the record can be made with one operation immediately after the picture has been taken. The film is marked in the kodak.

The autographic kodak uses what is called the autographic film cartridge. This is made with a thin red instead of the familiar thick red and black (duplex) paper. The thin red paper is not lightproof in itself, but between it and the film is inserted a strip of tissue. This tissue serves two purposes: to supplement the red paper in lightproofing the cartridge, and to permit the recording, by light, of the writing upon the film.

The autographic kodak has a spring door, on the back, covering a narrow slot through which the writing is done upon the red paper. The door is provided with an automatic safety spring border which prevents when the door is open to press the paper too closely with back of the film, thus securing the sharp printing of the image of the writing and preventing the entrance of light around the edges of the slot. This slot is located so that normally the writing comes between the exposures.

After the picture is taken, the door is opened, and with a stylus which is provided, or a smooth pointed pencil, held in as upright a position as is convenient, the photographer writes on the strip of exposed red paper any memorandum desired, such as the title of the picture, the data, or details regarding exposure, light, stops, etc.

The action of the stylus or pencil so affects the tissue as to permit the light to record the writing upon the film. After finishing the writing, the door should be left open for the printing, in accordance with a table for varying degrees of light. The exposure is made to the sky, but not to the sun.

The result is a negative, bearing a facsimile of the memorandum written upon the back of the red paper, developed on its margin or face as the case may be, the writing appearing in the foreground of a vertical picture or on the left side of a horizontal picture.

Do the Planets Affect Our Weather?

ONE of the correspondents of the Weekly News Letter to Crop Correspondents published by the Department of Agriculture wants to know whether the positions of the planets have any effect on the weather. The following is the News Letter's answer:

A few people strongly assert that they do, while many others have their doubts. Those, however, who have given the subject careful attention are positive that none of the planets, nor even the moon, ever has any appreciable effect on the weather.

As a matter of fact, all weather changes depend ultimately upon temperature differences. The temperature, as we know, constitutes of itself a most important weather factor. Another and equally important weather factor is rainfall. But to obtain rain it is necessary first to evaporate water from the surface of the earth, and this, as everyone knows, requires heat. Still another important weather factor is the direction and force of the wind, and this, too, requires heat, for the winds will not blow unless the temperature is different at one place from what it is at another, any more than the air will draw up a chimney when there is no fire in it.

Since then the heating of different parts of the earth and its atmosphere to different temperatures is the real cause of the winds and of all weather changes it follows that the moon and the planets can affect the weather only so far as they supply heat.

Now, according to accurate measurements made with the most delicate instruments, the amount of heat sent to the earth by all the planets and also by the moon is insignificant in comparison to the amount that comes from the sun. Hence, we could not expect either the planets or the moon appreciably to affect the weather. They do not supply enough heat, the one thing that causes all our weather changes.

To most people the foregoing reasoning may seem quite sufficient and conclusive, but there is still another and an entirely different method of testing the whole question. We can observe the positions of the planets and the kind of weather during each position and see whether the same sort of weather always comes when the planets are in the same position. This kind of examination has often been made, both for the planets and for the moon, but not the slightest influence of either upon our weather has ever been found.

To sum up: We have every reason to believe that neither the planets nor the moon can have any appreciable effect on the weather, because they furnish so little heat upon which all weather changes ultimately depend, and this belief is fully supported by weather records.

The belief, still to be found in all countries, that the planets and the moon do affect the weather never had any scientific basis whatever; it is only a remnant of the many superstitions generated and fostered by that other and greater superstition, astrology.

The Wireless Outfit of the "Imperator" comprises three separate stations; one of 15 kilowatts, for long distance work; one of 8 kilowatts, mainly for communicating with vessels at moderate distances; and an emergency station worked by a powerful storage battery. The main station can exchange signals directly with the large land stations of America or Europe during the whole of the transatlantic voyage, so that the delays involved in relaying messages from ship to ship are avoided. In midocean the ship is in communication with both the German station at Nauen, Osloh and the American station at Sayville. The emergency station, intended for use in case of a stoppage of the ship's dynamos, is capable of operating for 400 hours.

Correspondence

[The editors are not responsible for statements made in this correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A Sanitary Swimming Pool

To the Editor of the SCIENTIFIC AMERICAN:

The issue of June 13th appears a very interesting article on the installation of swimming pools. This subject, as applied to numerous lakes and so-called mineral springs. These have always been considered clean and sanitary, but I noticed at one of our largest springs, a lot of floating moss remaining stationary outside of the "boil," showing that a good deal of this water remained in a dead space. The rocks in these springs are covered with this slimy moss, and it is reasonable to assume this moss is an ideal breeding-ground for bacteria. Our lakes and rivers contain necessities, leeches, stingrays, etc., and are therefore not safe; but the most danger lies in the warm, shallow water at the edges, which in this warm climate smells strongly of decaying bacteria and vegetation.

I have a shell-mound located on the St. John's River and Lake Monroe, three miles below the city of Sanford. The ground is covered with immense live oaks, tall palms, etc. Four years ago I cleared off the underbrush, logs, stumps, and superfluous trees, fenced the land, built a small dock for boats to land, put in various cheap amusements, and built the most sanitary pool I have seen yet. A pit from which shell had been shipped for road paving was dug out deeper and on straighter lines up to the edge of a number of large live oaks, the bottom cemented, and the walls built of wood framing fastened to these big oaks and covered on the inside with galvanised sheet-iron, well painted. This is filled from an artesian (sulphur) well, which has enough pressure to allow a strong shower-bath also. As the population is small, this pool is used only two days in a week, and is emptied after each day's use, the water being used to flush the toilets. The following days, sun and air thoroughly disinfect the empty basin, which is then swept out and refilled over night with pure water from the artesian well. Rooms and suits are sprayed with a good disinfectant. The trees around the edges give the pool a natural "swimming-hole" appearance. Diving stage, toboggan slide, etc., add to the pleasure of bathing. The pool is 85 by 30 feet, but irregular in shape, to preserve the trees for shade over the pool. Depth of water is 3 feet 6 inches at one end, increasing to 5 feet 6 inches at lower end, therefore perfectly safe for children to learn to swim. The water from well is 73 deg. Fahr., but warms 8 to 10 degrees in the pool on a warm day. The amusements on the grounds are nearly all original, and would take too much of your space to describe them, but they give great pleasure.

V. SCHMELZ.

Sanford, Fla.

Energy from the Sun

To the Editor of the SCIENTIFIC AMERICAN:

Unless I am greatly mistaken, the writer of the critique bearing the above title in your issue of the 23rd of May, 1914, is much indebted for his statements to a similar article which appeared on page 495 of *Engineering* (London) of 10th of April, 1914, and this indebtedness extended not only to facts, but also the several mistakes or misleading statements which I had to write and correct, as you will see by the correspondence columns of *Engineering* of 24th of April, 1914, where it is pointed out that the original paper carefully called attention to the fact that the engine-end of the Meadi plant (which has nothing to do with the utilization of solar energy *per se*) was in a very bad state; that, consequently, the pump horse-power had not been given in the official report, and that, in order to make a fair and scientific estimate of the brake horse-power per acre, the results of the Meadi absorber had been combined with those of the fifth engine. This being done, it is shown that the best hour's run on August 22nd, 1913, gave 55.5 brake horse-power for an area of 0.88 acre occupied by the absorber = 63 brake horse-power per acre, while the average power for the five hours' run on that day was 50.4 brake horse-power per acre. This same method of combining two sets of results had to be adopted in the case of the Tacony trials of 1911, and for the same reason. The writer of the article in *Engineering* of 10th of April, 1914, quoted the figure (18.84 brake horse-power = 68.3 brake horse-power per acre) then obtained for the Tacony absorber, but did not compare it with the corresponding figure (60.4 brake horse-power per acre) for the Meadi absorber, and consequently arrived at the erroneous conclusion that "somewhat better results were obtained in some previous trials with condensing," i. e., at Tacony. This, it will be seen, is far from being the case, even on the basis of the area of land occupied by the absorbers, though in my opinion it is the steam produced per square foot of radiation that is the scientific basis of comparison, and on this the Meadi results are shown on page 108 of my paper to be 33 per cent better than the Tacony ones.

The same article also refers to "the great variability in the rates of power produced." Taking the five-hour run on August 22nd, 1913, the maximum brake horse-power was 55.5, and the minimum 46.2, or a total decrease of 16.8 per cent. This was far less than (67.9 per cent) in the case of the Tacony absorber, and less than was anticipated; but when the power is used for irrigation purposes it matters extremely little that more water is pumped during the mid-day hours than in the morning and afternoon. In addition, it should also be noted that the plant gave the best commercial result when working at a steam pressure of 4½ pounds per square inch by gage.

Your journal has (as the bibliography at the end of my paper indicates) for so long been well supplied with information on this subject, that I am sure you will like to have the data as correct as possible, and that, consequently, you will be good enough to give this letter as much prominence as the article in your issue of 25th of May.

A. S. E. ACKERMANN.

London, England.

Conditioning of Textile Materials

To the Editor of the SCIENTIFIC AMERICAN.

In his article on "Science and the Tariff," which appears in your issue of June 27th, DR. E. E. Pickrell gives a very accurate and interesting account of the method of determining the moisture in cotton yarn and cloth under the Underwood tariff law, but fails to call attention to the long neglect of this matter by the Treasury Department, and to the great need of scientific investigation of moisture regain for textile materials at the present time. Drying out textile materials and then adding a certain percentage to the dry weight in order to bring the total weight to a standard agreed upon, are very simple operations, called "conditioning," which was adopted by the French silk trade 146 years ago, and later was adopted for wool, cotton, flax, and other materials in order that the buyer of textiles by weight might always pay for a uniform quantity of water. The moisture present in textile fibers varies with the temperature and humidity, so that unless the material is conditioned the weight, and consequently the cost when sold by weight, vary with the weather

On March 2nd, 1861, a cotton tariff law was enacted, under which the classifications were so arranged that the duties rose and fell as the weight varied with the moisture present. Except for the eleven years from 1883 to 1894, this has been the case under our textile tariffs ever since, but not until October of last year was there any attempt to condition cotton textiles for tariff purposes. Cotton duties rose and fell with changes in temperature and humidity, and apparently the Treasury officials were not aware of the fluctuations. This is the more surprising because the remedy was the adoption, not of a complicated and highly scientific process, but the very simple practice of conditioning, with which the textile trade had been familiar for more than a century. With the Treasury officials themselves awakened so recently to the conditioning of textile goods, it is not surprising that but few of the general public know about the practice.

The moisture present in textiles varies not only with temperature and humidity, but also with the kind of material, so that different standards for moisture regain have been adopted: 8¼ per cent for cotton; 11 per cent for silk; and 18¼ per cent for wool tops. These standards have been adopted by the European trade to conform to weather conditions in Europe. The 8¼ per cent standard for cotton and the 11 per cent for silk are recognized in all parts of the world, but the conditioning standard for wool varies in different localities, Bradford, England, accepting 18¼ per cent, while Mazamet, France, recognises 17 per cent.

These variations for wool and the occasional agitation to establish regain standards in the United States for other materials, differing from the foreign standards, make it necessary that the regain at different degrees of temperature and humidity be determined with scientific precision. The best known tests for this purpose are those made by Th. Schloesing fils, Paris, and by W. D. Hartshorne, Lawrence, Mass. The former tests were made by a scientist at the request of French manufacturers, but are not extensive enough to meet present needs. The latter were made by a mill manager in his mill, and are thus subject to the unavoidable errors that accompany research work carried on under such conditions. Extensive tables for both wool and cotton have been based on Hartshorne's observations, but it was undoubtedly necessary to force the values for wide spaces, as his observations included only the actual variations in the weather at Lawrence.

What the textile trade needs to-day is an exhaustive series of tests to determine the moisture regain for the different textile materials for every possible combination of temperature and humidity in the entire range of weather variation throughout the world. This work should be done by scientists of unquestioned ability under conditions free from trade influences and calculated to give the highest possible degree of accuracy regardless of its effect on arbitrary trade standards. The data thus obtained and the observations of the U. S. Weather Bureau would enable conditioning standards to be intelligently established for textiles. This is scientific work that would be of great and permanent value to the textile industry, not only of the United States, but of all countries. It comes within the scope of the National Bureau of Standards, as defined by the law creating that bureau, and its successful accomplishment would be a mark of distinction for any scientific institution. Instead of pointing with pride to the belated adoption in 1913 of the old and well-known operation of conditioning, government scientists should recognize their long neglect of the question and be stimulated to do real and important scientific work in connection with the moisture regain of textile materials.

Boston, Mass.

SAMUEL S. DALE.

Reduction

To the Editor of the SCIENTIFIC AMERICAN:

It is said by *astronomers*, reduce ninety-two million miles, more or less—in other words, the distance from our earth to the sun—to one inch (and that is surely some reduction), then we would have to travel five miles to reach the nearest fixed star, possibly a nucleus for another solar system. Does not such contemplation also reduce our ego?

But maybe the cynic proclaims: "When he beholds a great puffing gas buggy, a cardinal red chariot approaching, yclept touring car, ensconced therein a bespectacled, somewhat chesty individual; may he be permitted to imagine this mighty man as an 'apendectomologist'?" Be that as it may, the time has arrived when no longer can we look wise and say nothing. The people demand value received. My prognosis is, that specialty will predominate, and we shall arrive at a point when reduction in the number of practising physicians will be necessary for the welfare of the profession at large, and to retain due respect from the observing laity; then will be found a composite practitioner and eminent scientist, steeped as it were in medical lore, who must possess a mentality for genius, combined with a large percentage of common or horse sense, and he will operate the diagnostic values alone. His clientele will be placed, after his first inspection, under the care of the medical specialist, surgeon, or super-trained nurse. At the present time, trained nursing does not meet with the consideration and importance that it should. The responsibilities should be divided up more, between the immediate and continuous attendant upon the sick and the visiting physician, when there will be less excuse perhaps for the shifting of responsibility, or the relying on youth, in shape of the newly graduated, to carry out orders from the more experienced, and then again transmitted to the trained nurses. This system is faulty and open to argument.

Let us even change titles to modern needs. An "experienced disease expert," under the supervision of a scientific and thoroughly posted professional, would sound better than doctor or doc. The said professional would not visit his patient so often; awaiting to be called upon by the disease expert, thus saving time, energy, and the income of his client.

My motive in advancing a theory of reduction is not by any means a criticism of present methods, merely a note of warning to the profession. If we allow so numerous a proportion of doctors of medicine, and doctors of "what-not," then there is but one end—degeneration and cheapness; dragging down the worthy back to the conditions when a tonsorial artist and a blood letting chirurgeon were one and the same. In other words, make it difficult to attain a title that should carry with it every mark of respect. Have national examinations at intervals by a competent board. These mental endurance tests would correspond with the present physical tests of fitness for other known Government employees. Further, when a grievous mistake in diagnosis is made, and wrong treatment followed by disaster to the patient, then some redress should be obtainable for this patient. Too many upstarts, whose main asset is their colossal assurance and conceit, have injured the profession already; and it is high time for that profession itself to look to its own welfare, and not depend upon outsiders, who criticise, but do not lend a helping hand.

The above was suggested to my mind by a remark made by a merchant acquaintance, who being grieved over the death of his child, said that the Pure Food and Manufactured Goods Law should apply to doctors' mistakes.

J. A. GUTHRIE, M.D.

Surgeon United States Navy, Retired.

Portsmouth, Va.

Completing the Ashokan Reservoir

Storing a Supply of 500,000,000 Gallons Per Day of Mountain Water for New York City

IN spite of the fact that the present Croton dam and the old and new aqueducts are capable of supplying New York with nearly four hundred million gallons of water per day, so rapid is the growth of the city that it became necessary, several years ago, to find an additional source of supply, which would cover the needs of the city for many decades to come. After an exhaustive examination of all possible sources of supply by an expert board of hydraulic engineers, it was decided to utilize the excellent drinking water of the streams of the Catskill Mountains. The site for the main dam was selected in the valley of Esopus Creek, to the west of the Hudson River, at a point some ninety miles from New York. The first construction work on the Ashokan reservoir was begun September 30th, 1907, and the whole work will be completed by December, 1915.

The putting through of the scheme for the new Catskill water supply, and the organization of the work on a basis which would free it from political interference, was one of the most notable achievements of Mayor George B. McClellan; and the Board of Water Supply, as thus organized, is to be congratulated on the uninterrupted progress of the work, and the efficiency with which it has been carried through under the leadership of its chief engineer, J. Waldo Smith, and his able corps of consulting and departmental engineers.

The estimated cost of bringing the water to New York was $161,857,000. Subsequently the scheme was enlarged to include the delivery of Catskill water to all the boroughs of the city, including those of Manhattan, Queens, and the Bronx, and this increased the estimated cost by $15,000,000.

The four watersheds from which the supply is to be drawn are situated west of the Hudson River in the Catskill Mountains, and lie between 75 and 135 miles from New York City Hall. These watersheds have an aggregate area of nearly nine hundred square miles. For the present, the supply of the Esopus watershed, which embraces an area of 255 square miles, will be utilized. When it becomes necessary to take in the other watersheds, Schoharie can be tapped by means of a tunnel through the dividing range, and the Rondike and Catskill watersheds can be made to contribute their quota, the first directly to the main aqueduct to New York by what will be known as the Rondout aqueduct, and the latter by an aqueduct from Catskill Creek, which will lead into the Ashokan reservoir. From this gathering ground it will be possible, in a series of unusually dry years, to draw seven hundred and seventy million gallons daily the year through.

The most important reservoir of all, when the four watersheds shall have been developed, will be that at Ashokan, which has been formed by the construction of a great masonry dam across the Esopus Valley, which is known as the Olive bridge dam. From Ashokan reservoir to the city's northern boundary there are 92 miles of aqueduct, and it is 127 miles from the reservoir to the borough of Richmond, Staten Island.

In addition to the Ashokan reservoir, which has a capacity of one hundred and thirty-two billion gallons, another large reservoir is being built at Kensico, east of the Hudson and twenty miles north from City Hall, which will have a capacity of thirty-eight billion gallons. This will act as an emergency storage reservoir, so that in case of inspection, cleaning, or accident to the seventy-seven miles of aqueduct between Kensico and the Ashokan reservoir, it can act as an emergency storage reservoir. The cost will be $8,500,000. The third reservoir, which will be known as the Hill View reservoir, is being constructed in the city of Yonkers, just over the New York city line and 15 miles south of the Kensico reservoir. It will hold nine hundred million gallons of water, and its duty will be to equalize the difference between the use of water in the city, as it varies from hour to hour, and a steady flow in the aqueduct. Also it will furnish a large amount of water upon immediate demand, such as would occur in the case of a great conflagration.

Ashokan reservoir consists of two large basins known as the east and the west basin. The west basin lies in the valley of the Esopus, and the east basin, which is divided from the former by a weir, has been formed in a natural basin among the hills, the depressions being closed by a vast system of huge earthen dikes having a total length of 5½ miles. The keynote of the whole of these vast works is the Olive bridge masonry dam, which is 4,600 feet long, 220 feet high, 119 feet thick at the base, and 23 feet thick at its crest. The west basin formed in the valley of the Esopus by this dam has a total capacity of fifty billion gallons of water. The east basin has a maximum capacity of eighty-two billion gallons. The water surface of the wh[illegible] reservoir is 12.8 square miles, and for the construction of the reservoir no less than 15,222 acres of land were acquired. The length of the reservoir is twelve miles, and the length of the shore line is forty miles. As showing what this quantity of water means, it may be stated that it would be sufficient to cover the whole of Manhattan Island to a depth of 28 feet, and that the area of its surface would be equivalent to that of the whole of Manhattan below 116th Street.

The main Olive bridge dam of solid masonry was carried down everywhere to solid, impervious rock. An interesting feature of its construction is that it is built in sections, with vertical expansion joints running entirely through the structure in an up-and-down-stream direction, which permit of changes of length, due to variation of temperature, and eliminate those stresses which, in a continuous dam, result in minute cracks through which seepage may occur. The miles of earthen dikes form a most impressive spectacle. Each of the dikes consists of a central masonry core-wall, carried down to solid rock, backed on both upstream and downstream sides with huge masses of clean earth from which all boulders have been picked, the earth being laid in 6-inch layers, and thoroughly compacted by heavy steam rollers.

One of the most important works is the spillway and waste weir with a crest elevation of 587 feet above sea level. The length of the crest is 990 feet, and the water which is wasted over the spillway flows through an open channel to empty into Esopus Creek, 2 miles below Olive bridge dam. Another massive and picturesque construction is the weir dividing the west and east basins, which is spanned by a 15-arch bridge 1,270 feet long. Although the construction of the dams and dikes, massive and complicated headgates, etc., forms the major portion of the work, the construction of the reservoir involved a vast amount of preliminary work as the following statistics will show:

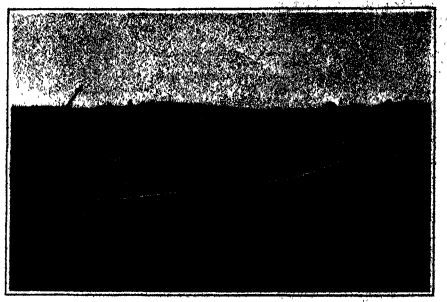
In the first place, the whole of the bed of the reservoir had to be cleared of all vegetation, trees, villages, and buildings. No less than seven villages were submerged, the total population of which amounted to 2,000 souls. Thirty-two cemeteries were removed and 2,800 bodies had to be taken up and re-interred. The Ulster and Delaware Railroad originally ran through the Esopus Valley, and this had to be relocated on the high land adjoining the reservoir, a work which involved a relocation totaling 11 miles. Furthermore, 64 miles of highways had to be discontinued and 40 miles of new highway of the very finest bituminized macadam have been built around the reservoir. This highway has involved the construction of no less than ten reinforced concrete bridges. We illustrate two of the most handsome of those—a five-span bridge over Esopus Creek and a 200-foot single span bridge across Traver Hollow. These bridges are of reinforced concrete and, as our illustrations show, they are of excellent and appropriate design, adding greatly to the generally picturesque appearance of the landscape immediately surrounding the reservoir.

A most important and commendable work is the clearing and reforestation of a belt of land about 1,000 feet in width entirely surrounding the reservoir. The existing woodlands are being cleared of all dead timber, young trees are being planted, and, in the course of time, this reservoir with its belt of forest land and its magnificent roadway will form one of the most picturesque automobile drives to be found in the United States.

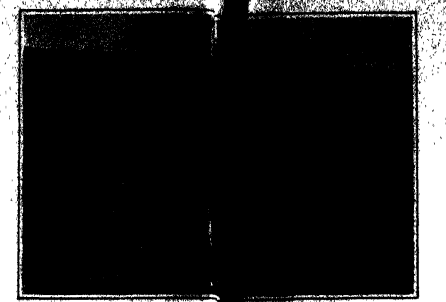
The work of building the reservoir has involved the excavation of nearly three million cubic yards of earth and rock, the placing of over eight million cubic yards of embankment, and of nearly one million cubic yards of masonry. The work of building the dam has employed steadily an army of about 3,000 men, who have lived, many of them with their families, in homes built by the contractor near the works. In this camp, which is a model of its kind, there is up-to-date sewerage, a water supply system, excellent dwellings, with screens on all doors and windows, well laid out streets, electric lights, telephones, savings banks, hospitals, police, fire protection, a Young Men's Christian Association, and a post office. The maximum population at one time was approximately 4,500 people.

Our thanks are due to the department engineer, Alfred D. Flinn, Department Engineer in New York, and to George G. Honness, department engineer on the reservoir, for courtesies extended in the preparation of this article.

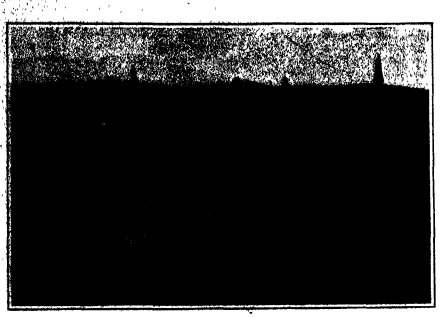
Humboldt's Correspondence.—Prince Roland Bonaparte has presented a work entitled "Lettres inédités de Humboldt." The letters are addressed to Aime Bonpland who was for four years the companion of Humboldt in his celebrated journey across America, and who, on returning to France, became intendant of the Empress Josephine, at Malmaison, then in 1816 set out for Paraguay. He settled down in the Argentine Republic, and kept up an active correspondence with Humboldt till his death.



The waste weir, over which the surplus waters of the reservoir are discharged.



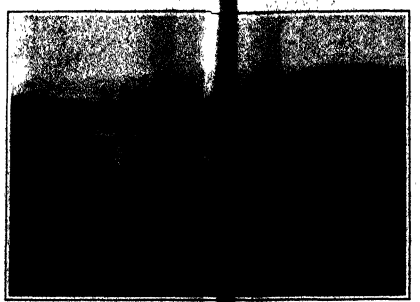
View showing elaborate continuation [illegible] of the Hill View reservoir.



One of the main earth dams, showing construction of core-wall, which is carried down to rock.



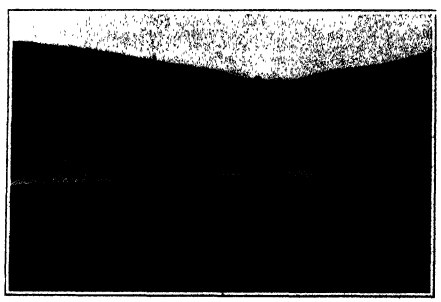
View from downstream of Olive bridge dam, showing temporary tunnel for flow of Esopus Creek.



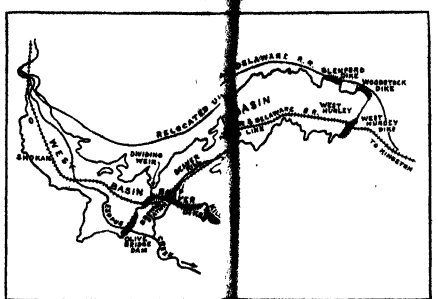
A 200-foot span arch bridge for carriage driveway around reservoir [illegible]



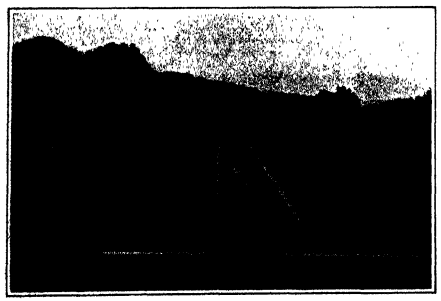
Upper gate chamber. Outlet from 60-inch valves at junction with low-pressure aqueduct.



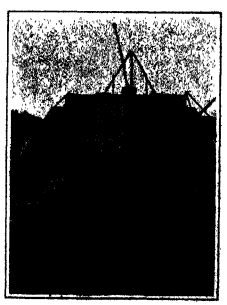
Handsome reinforced five-arch concrete bridge across Esopus Creek, upper end of Ashokan reservoir.



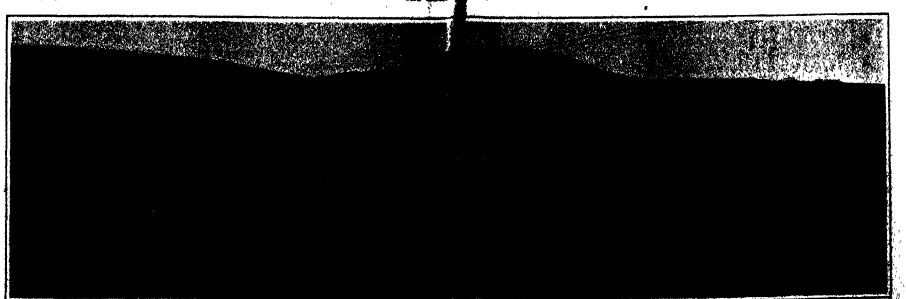
Map of Ashokan reservoir, showing [illegible] basins and the location of the dam [illegible]



View looking through the waste channel to Beaver Kill bridge.



West face of upper gate chamber, Ashokan reservoir.



The Olive bridge dam—Length of dam, 4,600 feet; height, 220 ft.; [illegible] at base, 119 feet. Capacity of reservoir, [illegible]

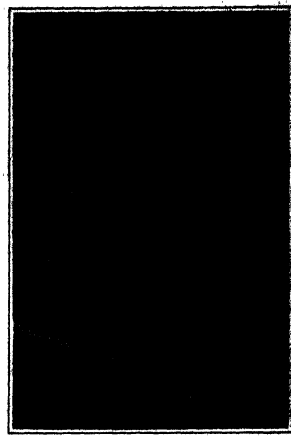


Traver Hollow bridge during construction.

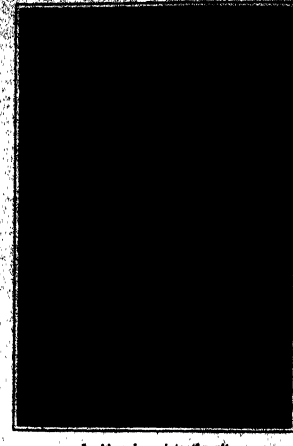
ASHOKAN RESERVOIR—A MONUMENTAL WORK IN THE CATSKILLS [illegible] FLOW NEW YORK DAILY WITH 500,000,000 GALLONS OF WATER.



The mouth of the "bottomless pit."



The basin, showing the pit at the far end.



Looking down into the pit.

A Bottomless Pit

By Henry H. Riggs

THE road between Chermonk and Chunkoush, in the Turkish province of Diarbekir, passes through a limestone region where the rains and floods of ages past have washed the rocks into a thousand grotesque and unexpected forms. Caves and cavities of all shapes and sizes abound. One of these caverns is of more than usual interest. About midway between the two towns named the road crosses a broad valley, which slopes gently toward the southwest. The drainage water of this valley forms, in the wet season, a small stream, which, in time of heavy rains, becomes a torrent of no small size.

At the point where the road crosses this valley, the stream has cut for itself a channel in the floor of the valley, which grows a little farther down into a deep, rocky gorge, and finally ends in a basin fifty feet deep and two hundred feet or so across. Climbing down the deep side of this basin, one comes at the bottom to the mouth of a vertical sink hole into which the stream plunges and disappears. The mouth of the cavern is about eight by fifteen feet in size, and from the edge appears to be perfectly vertical, somewhat larger below than at the mouth. No hint of the bottom is visible.

When first visited by the writer in April, the spring torrent plunged into the cavern, and little could be seen or heard but the deafening cataract. A recent visit, in October, gave better opportunity for examining the cavern. There had been no rain since spring, and there was no stream at all. Looking down from the edge, the overhanging sides of the cavern could be seen for a considerable depth, but the cavern broadened out below, giving the impression of enormous width and depth. Stones were dropped into the cavern to determine its depth. As a stone gathered headway, the whirring of its flight through the air, reflected and multiplied by the walls of the cavern, came up like the roar of a storm in the forest.

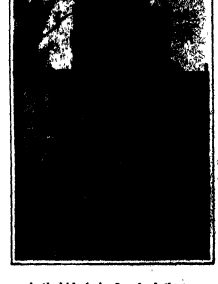
A heavy stone, nearly spherical, dropped from the hand, fell for four and a half seconds before striking anything. This, after allowing for air resistance and the time taken for the sound of impact to reach the ear, would indicate a straight drop of more than 300 feet. After the first impact, however, the stone dropped for another two seconds before it touched again, and bounded on down for another two seconds before coming to rest. If, as seems probable, the first impact was a glancing blow which did not materially retard the fall of the stone, the second impact must have been not less than 650 feet from the mouth, and the bottom may have been two or three hundred feet lower yet. This is a prodigious depth for a practically vertical drop, and the spring torrent plunging down from that height would be a notable waterfall were it not hidden from view.

An interesting problem is where this subterranean channel discharges. In times of heavy rain the torrent rushes into the cavern in such volume that the opening is completely filled, and the bottom of the basin becomes a seething vortex, into which the turbid waters carry boulders of no small size. No springs in that neighborhood show signs of discharging these flood waters. The natives of the region have tried the experiment of dumping chopped straw into the stream and watching for its reappearance in streams below, but without result. The valley slopes gently away to the Euphrates River, fifteen miles away, and it does not seem possible that this cavern has any outlet at any point nearer than that. Here is an opportunity for someone in search of interesting adventure to descend this pit and explore the cavern to its outlet or outlets. He might find a very extensive underground world, which the eye of man has never seen.

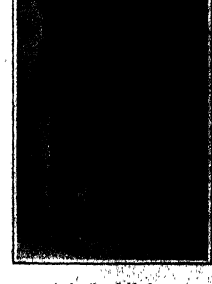
New Type of Tire Chain

IN many cases it is useless to apply the ordinary pleasure car type of tire chain to the dual wheels of heavy motor trucks, on account of the relative inelasticity of solid rubber tires and the enormous weight carried. Furthermore, the cutting action of the rim flanges prohibits the use of any chain device passing around the tires. A stationary device or ordinary cable chain warped around the tire and striking the same spot continuously, will cause a deep cut in the tire.

With these facts in mind the anti-skid device here illustrated was developed. It consists of drop-forged steel cross-pieces or frogs, specially treated to give tough wearing qualities, connected by tested links to form a continuous chain between the dual tires. Provision is made for taking up slack of the chain in consequence of the wear of the tires. The cross-pieces are not stationary, but constantly change their position, so that wear on the tire is uniformly distributed. The non-skid device is easily attached and detached without jacking up the truck, while the shape of tread insures perfect traction and absolutely prevents skidding. It is claimed that the device cannot damage any part of the wheel, and being fitted between tires cannot foul the driving chain.



Anti-skid chain for dual tires.



A shooting field glass.

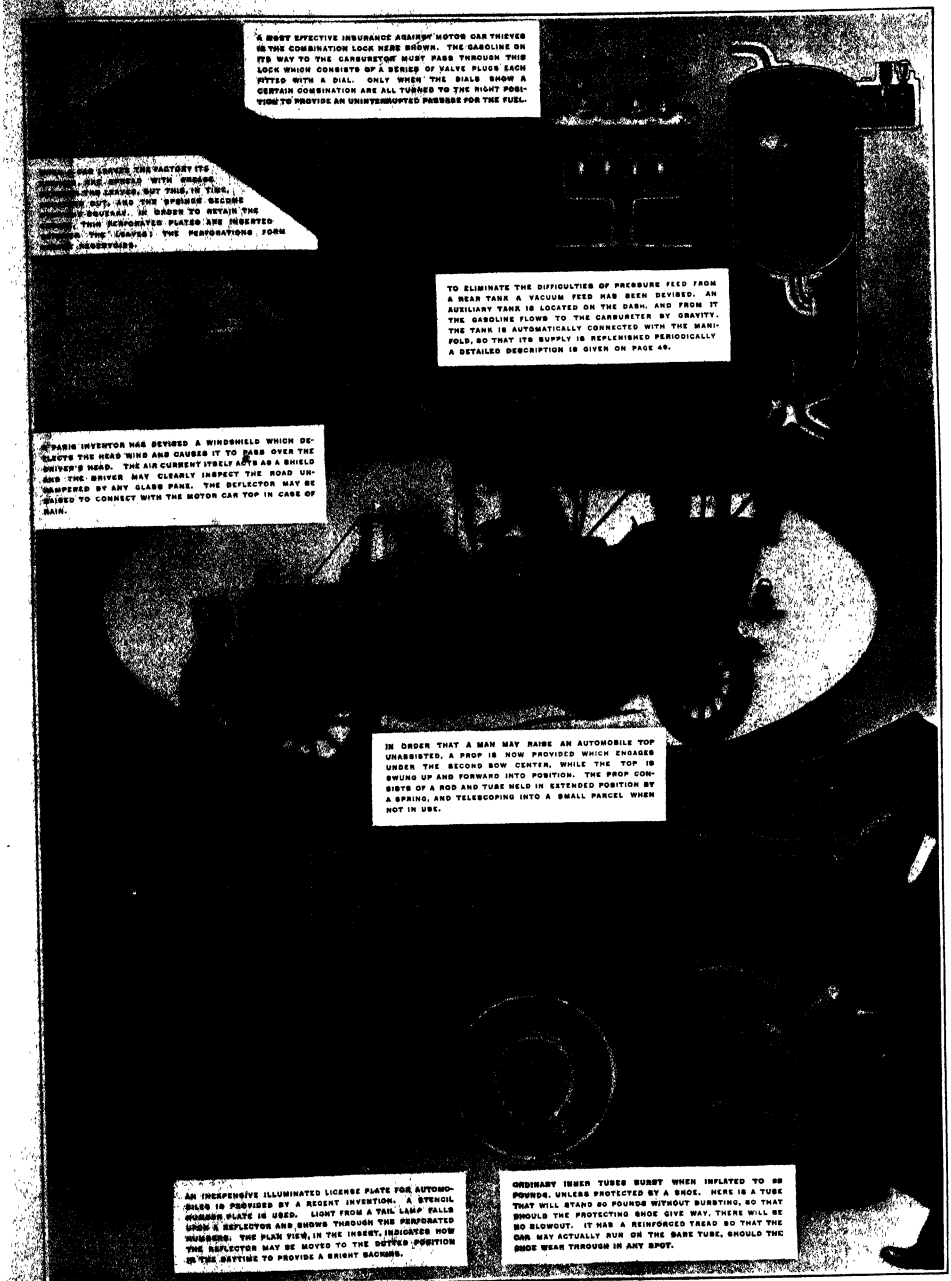
A Shooting Field Glass

A NOVEL weapon for marksmen and hunters has recently been developed. The invention consists of a pair of telescopes in unit adjusted to a short rifle between them. The telescope may be easily detached and used individually without the gun. The gun is steadied and rested against the forehead by means of a recoil pad. The recoil is taken up by means of a series of flat springs arranged like a carriage spring, one leaf on top of the other, and a soft leather padding, which in aiming is rested against the forehead, steadying the gun. On guns with an extremely heavy recoil, shoulder stocks are used in addition. Using two telescopes, a perfect stereoscopic picture is obtained. The full power of a man's vision is in use while aiming. It is claimed that accidents which have so often occurred should now be reduced to a minimum, as one may easily distinguish what he is aiming at.

Mr. Demele, the inventor, conceived of the binocular telescope gun while on an extensive hunting trip in northern Quebec, when he saw what appeared to be a bush moving in the distance. With the aid of his field glasses he detected the cause of it to be a bear scratching the ground in the dense brush. He dropped his glass and raised his rifle for a shot, but missed his bear, as he expected. This suggested to him the advantages of being able to shoot with the aid of a glass.

The gun used for experimenting is shown in the photograph and has a range of 1,800 yards and a penetration of ¾-inch boiler steel at that distance. Two hundred shots were fired in rapid succession with astonishingly good results.

Why Popcorn Pops is not fully understood, says a recent bulletin of the Agricultural Department. Formerly it was supposed that the popping resulted from the expansion of oil in the kernel on being heated, but more probably it is due to the expansion of moisture contained in the starch cells. This moisture expands when heated, with explosive force, causing explosion of the cells and the kernel turns completely inside out, exposing the embryo and hull. Possibly the expansion of the air within the cells may also play some part in the process.



SOME RECENT AUTOMOBILE ACCESSORIES.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

SHOULDER BRACE.—E. F. SMALL, 1402 Candler Building, Atlanta, Ga. The invention relates to body braces, and more particularly to a shoulder brace, the object being to provide a light sanitary brace particularly adapted for women's wear, which may be readily adjusted to fit, and will automatically adjust itself in accordance with the body movement of the wearer

SAFETY CUFF BUTTON SHIRT.—J FALKENBERG, 846 E. 86th St., New York A common objection to soft shirts is the danger of losing valuable cuff buttons. To avoid this danger, the present invention provides a safety attachment for a soft shirt cuff which has constant co-operation with the shank of the button, and will prevent the loss of the button, even though it should pull loose at one or both ends.

NECKTIE HOLDER.—M. ROSENFIELD, 1339 Burbank St., Alameda, Cal. The invention relates to a necktie holder of the kind that are secured over a collar button, and provided with means to engage a tie and prevent it from shifting to either side or above its intended position. The present invention provides an improved tie engaging means whereby the tie may be more effectively and more readily released than is possible with holders now in use

Electrical Devices.

ELECTROMAGNETICALLY CONTROLLED KEYBOARD FOR PERFORATING APPARATUS.—B. SOLDATENCOW, 37 Rue La Pérouse, Paris, France. This invention has for its object to provide an electromagnetically controlled keyboard for perforating machines intended for the perforation of the bands of paper utilized for telegraphic apparatus, for example, and it is mainly intended for increasing the rapidity of perforations, while at the same time rendering the machine strong and insuring certainty in operation

Of Interest to Farmers.

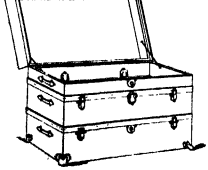
BALING PRESS.—G. F. MADDEN, Roosevelt, Utah In brief this hay baling press comprises a housing in which the bale is to be formed, a hopper for guiding the material in front of a plunger, and a belt moved by the plunger in one direction and by a weight in the other, the belt acting to prevent the feeding of material into the housing while the plunger is in a forward position, and serving to retract the plunger by reason of the weight acting thereon The plunger is actuated by a suitable set of cams which are turned by any desired power

MACHINE FOR HEADING GRAIN.—C. WOOD, Box 831, Moulton, Iowa This machine for heading grain is adapted to perform its functions in connection with a harvester and binder. It receives the laterally discharged grain from a harvester and binder with the binding devices removed, and heads the grain thus received, discharging the stalks or straw in one direction and the grain heads in another direction.

DEEP TILLING ATTACHMENT.—E. ROBINSON, Selby, S. D As an attachment for plows, Mr Robinson provides a device which takes the place of the front furrow wheel and similarly forms a support for the frame of the plow, also a guide for the plow Therein it differs from other attachments which are provided with an independent frame detachably secured to the plow, and have adjustable means independent of the means existing on the plow

Of General Interest.

SECTIONAL TRUNK.—F. DEC THOMPSON, 18 McDonough St., Brooklyn, N. Y. By constructing a trunk in sections, Mr. Thompson provides an article which may be enlarged or reduced in capacity, according to the needs, at



SECTIONAL TRUNK.

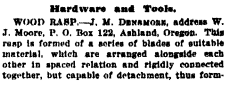
any particular time. The trunk consists of a rectangular bottom section with any number of intermediate sections, each fitted with locking devices for fastening them in place Any of the sections may be provided with trays

WALL CONSTRUCTION.—F. J CAHILL, Suisun, Cal In order to construct a concrete wall having a degree of elasticity not less than that of brick walls, the present invention contemplates molding the concrete in separate, distinct blocks *in situ* in successive layers, to break joints as in walls built of previously formed blocks. Metallic joint members are provided and form part of the mold, their shape being such as to cause interlocking of adjacent blocks.

APPARATUS FOR MELTING AND PROJECTING FUSIBLE SUBSTANCES.—E. MOOR, Zurich, Switzerland. The object of this invention is to provide an apparatus for projecting a fusible substance, as for example a metal wire in a molten state, against a surface for the purpose of providing the same with a fixed or detachable coating. The appliance is either portable or stationary, as most convenient for the work to be performed.

Hardware and Tools.

WOOD RASP.—J. M. DENAMORE, address W. J. Moore, P. O. Box 122, Ashland, Oregon. This rasp is formed of a series of blades of suitable material, which are arranged alongside each other in spaced relation and rigidly connected together, but capable of detachment, thus forming a rasp having openings for permitting the escape of the material cut away. The efficiency of the rasp is increased by providing this clearance and preventing the collection of the material in the rasp to block the cutting mechanism



WOOD RASP.

SAW.—H. C. NUGENT, 6 W. 104th St., New York city, N. Y. The present invention provides a saw in which the serrated portion or edge may be easily removed from the body or back to which the handle or other operating means may be applied, the toothed edge being so arranged as to be either replaced or to have another blade of a different character substituted therefor

Heating and Lighting.

GAS LIGHTER.—G MEYER, 19 Logan St., Auburn, N Y Finding that the customary catalytic material used in gas lighters may be kept in good condition if properly housed, Mr. Meyer has invented a gas lighter in which the catalytic member is inclosed until the instant it is to be used. Then it is exposed to the catalytic action for as short a period as possible, after which it is housed again.

Household Appliances.

CLOTHES DRIER.—E. A WILLIAMS, Canton, Pa. To provide a clothes drying apparatus suspended from the ceiling of a room; to provide for lowering and elevating the apparatus; to provide for locking the apparatus in raised position, and to provide a means for removing operative parts of the apparatus to avoid interference by persons passing, such are the principal objects of Mr. Williams's invention.

Machines and Mechanical Devices.

ROTARY PUMP.—B. F. CATHCART, 702 K St., Fresno, Cal This invention relates to improvements in rotary pumps of the vertical type, and has reference more particularly to the casing structure for the pump. An object



ROTARY PUMP.

of the invention is to provide an inexpensive, simple, and efficient rotary pump relieved of end thrusts The liquid pumped is given a spiral motion by providing spirally directed inlets and outlets.

WOOD MOLDING MACHINE.—L. R. CARROLL, 9 S. Brevard St., Charlotte, North Carolina. This molding machine is provided with a principal bed which may be moved to any desired radius at the will of the operator, and which may be raised or lowered when thus moved The machine also has an improved arrangement of the chip-breaker, whereby it may be adjusted to accommodate different positions of the adjustable bed.

Musical Instruments.

PNEUMATIC ACTION.—H. R. HOLTSANG, 1299 Bell Ave. Lakewood, Ohio. An improved pneumatic action is provided by this invention for pipe organs and the like. It is arranged as a conducting device for the union, coupling, confluence, or conjunction of a plurality of ducts controlling the speaking apparatus of sounding or mechanical devices, or of independent ducts or other means, directly or indirectly, for the various functions found in a pneumatic action.

Prime Movers and Their Accessories.

PISTON RING REMOVER.—M. MARTIES, P. O. Box 363, Flint, Mich. This piston ring remover has means for engaging between the split ends of the ring, to spread the ring, so as to permit it to be slipped off the piston without distorting or twisting the ring. The engaging portions of the remover are capable of adjustment with respect to each other, for permitting the remover to be used with any width of ring

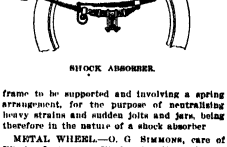
EXPLOSION TURBINE.—P. C. ANDERSEN, Viborg, Province of Jutland, Denmark. This explosion turbine comprises a rotating part and a stationary inner part surrounded by the rotating part and containing piston chambers open at their ends, an axial shaft for said rotating part, pistons for the piston chambers and mounted from the shaft, the rotating part forming the end wall of the piston chambers, and having one exhaust turbine channel for the piston chambers lying in the same horizontal plane, and suitable packing interposed between the rotating part and the chambers.

Railways and Their Accessories.

FREIGHT CAR DOOR.—A. HOLLAND, Nome, N. D. The invention provides a door which may be easily opened, even when the car is filled, and which may be swung up in position out of the way, so as to facilitate the loading or unloading of the car The car door is telescopic, having an extension which may be used when the car is being filled with grain or other light material.

Vehicles and Their Accessories.

SHOCK ABSORBER.—K. SATO, 445 S. Olive St., Los Angeles, Cal. The invention relates more particularly to a spring mounting, equally adapted to the fore and rear ends of a



SHOCK ABSORBER.

frame to be supported and involving a spring arrangement, for the purpose of neutralizing heavy strains and sudden jolts and jars, being therefore in the nature of a shock absorber

METAL WHEEL.—O. G SIMMONS, care of Wissler Instrument Works, 611 North Broadway, St. Louis, Mo. The invention relates particularly to wheels for automobiles and comprises a hub, consisting of an inner member designed to be permanently secured to the axle and an outer hub member removable with the spoke and rim bodily from the inner member without disturbing the position or adjustment of the inner member. The hub is made stiffer and stronger and better adapted to the use of metal spokes than similar devices heretofore proposed.

POWER DRIVEN VEHICLE.—J. E. MATSON, Sandusky, Ohio. The object of this invention is to provide a complete power unit having a one unit frame, and in operative relation a prime mover, transmission mechanism, fuel supply, and controlling devices with means for readily and rapidly installing this unit in operative position, and for removing the same from this position Another object is to provide a vehicle chassis and a power unit arranged to facilitate the insulation of said unit upon, and its removal from, said chassis, with means for rapidly locking the chassis and power unit in operative relation.

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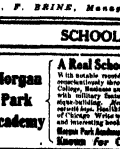
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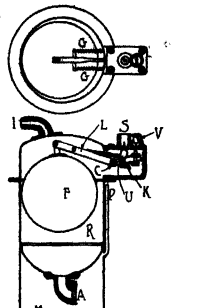
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Vacuum Gasoline Feed System

There are three places in which a gasoline tank is customarily located on an automobile; under the front seat, in the dash or cowl of the sixth-sided hood, and under the body at the rear of the vehicle.

With the advent of deep cushions the under-dash type of tank has been almost eliminated for two reasons; when placed so low gasoline will not flow to the carburetor, and because it is limited in capacity. This type of tank has been largely replaced by the rear tank because the latter can be made of large capacity. But the rear tank with the accessories accompanying it has not been popular on low-priced cars because of its expensiveness. An alternative is the dashboard tank, the main advantage of which is gravity feed. Further, with the rear tank and pressure system it is necessary to first pump up enough pressure by hand to raise gasoline to the carburetor. On the road the safety valve of the power pressure pump sometimes sticks, and a high pressure is put on the fuel. This either causes an excessive consumption of gasoline or flooding of the carburetor.

To eliminate these difficulties a vacuum feeding system has been evolved. The auxiliary tank, which contains the mechanisms, is located on the dash of the car so that the gasoline flows to the carburetor by gravity. It eliminates the pressure feed with the rear tank, also two extra pipe lines, a hand and a mechanical air pump and a pressure gage.



Plan and sectional views of the vacuum gasoline feeding device.

This auxiliary gasoline tank is connected to the main gasoline tank at *I*, to the carburetor at *O*, and by means of another pipe to the intake manifold of the motor at *S*. The tank is made in three pieces, a top, an intermediate and a bottom section. The two upper sections form one small reservoir *R*, and the bottom section another, *M*. The two are placed in communication when the valve *A* is opened. In the upper section is placed a float *F*, which regulates the supply of fuel. This float, through the medium of the springs *GG*, and the lever *K*, operates the two valves *V* and *U*.

The action is as follows: The upper reservoir *R* is full of gasoline, the valve *S* is closed, and the valve *V* open. When the valve *V* is open there is atmospheric pressure on the gasoline which will flow into *M* by gravity. As the gasoline is used up the float *F* descends. Note that the float has no positive connection to the other lever *K*, fulcrumed at the same point; only the springs *GG* connect the two levers.

The instant that *L* goes beyond a point at which *L* and *K* are in a straight line, the springs immediately throw *K* to the other extreme of its movement, reversing the valves. By the use of this ingenious combination of levers and springs the opening or closing of the valves is instantaneous. Opening the valve *U* places the upper chamber in communication with the intake manifold. The suction thus created in the chamber *R* closes the valve *A*, and sucks gasoline from the rear tank through the connection *I*. This action continues until the chamber *R* is filled, and the float having risen has reversed the valves. A vent pipe *P* is provided to let air into the lower reservoir when the valve *A* is closed.

At the bottom of the tank is placed a stand pipe *T*, which serves as a water separator and dirt strainer. A drain plug is provided to draw off the water and sediment. The lower chamber is always filled with gasoline, even if the upper one is dry. Hence, there is always enough fuel to start the motor, and once it starts the upper tank fills immediately.

Testing a Safety System for Storing and Distributing Inflammable Liquids

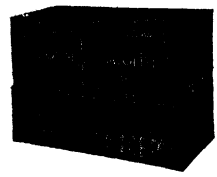
(*Continued from page 40*)

Though the gasoline burnt with a brilliant and lurid flame, for the few seconds until the automatic shut-off came into action, the contents of the storage tank were perfectly protected.

The demonstration, which took place on the old Guttenburg race track, at North Bergen, N. J., involved the construction of a sample or test installation such as would be used at a small garage with a storage tank of about 350 gallons capacity, and the various appliances for charging and discharging such as would be used in actual practice.

The underlying principle of the system is that the vapor of gasoline or other highly inflammable liquids will not ignite when in proximity to an inert gas, such as carbon dioxide or nitrogen, although a mixture of gasoline vapor and air is highly explosive, as is well known, for, in fact, it is on this property that the use of gasoline vaporized in the internal combustion motor of the automobile depends. In the Martini and Hilneke system carbon dioxide gas is derived from a cylinder of the gas under pressure that is liquefied in the ordinary commercial form, or a mixture of carbon dioxide with nitrogen, which, in the case of large installations, can be specially prepared at the plant, is in contact with the gasoline both in the storage tank and at all points where it is likely to be exposed. Carbon dioxide, when mixed with air in a proportion as low as 80 per cent, supplies a medium in which combustion is impossible. With this gas or mixture of gas taking the place of air in the space above the liquid in the storage tank or in the drum from which it is transferred, it is impossible for the vapor to ignite, as was demonstrated in a striking way by the passage of an electric spark through a spark plug inserted above the liquid in the storage tank. The inert gas used is reduced to a pressure of from 1 to 1½ atmospheres, this being sufficient for a basement or one-story installation.

Previously a demonstration had been made of the explosive effects of gasoline vapor where the space above the liquid was occupied by air. At the demonstration in question the electric spark was passed repeatedly across the gap in the spark plug, and thus it was demonstrated that the contents where protected by the system were perfectly safe from any action of lighting or stray currents. The inert gases under pressure supplying the protection in addition serve to raise the liquid to the draw-off valve through a double lead pipe, the inner pipe carrying the liquid and the outer jacket the gas, which is under the same pressure and in direct communication with the tank. A manometer regulates the pressure at which the gas is maintained constant throughout the system. This inert gas not only is present in the space above the surface of the liquid in the storage tank, but it is contained within the double pipe of the connecting system. These pipes are of lead, and any break in one or the other serves to release the pressure exerted on the liquid, so that the supply is automatic-



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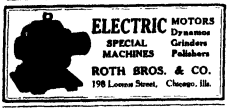
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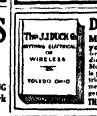
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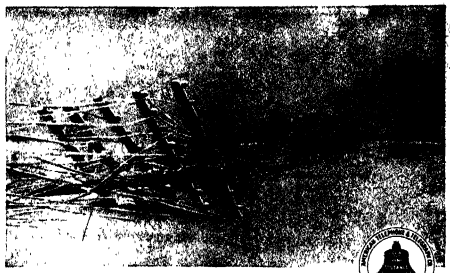
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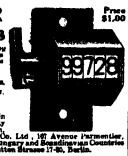
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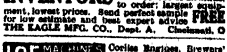
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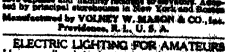
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LUBRICANTS

ally cut off and the air is kept away from the contents of the tank. The only entry of air is the mercury manometer mentioned above, and there are no check or other mechanical valves in the system which could deteriorate or fail to act. A liquid seal is used where the gasoline enters and emerges from the storage tank. This liquid seal or so-called "anti-fuser" prevents any air from entering the tank, making it impossible for any explosive mixture to form.

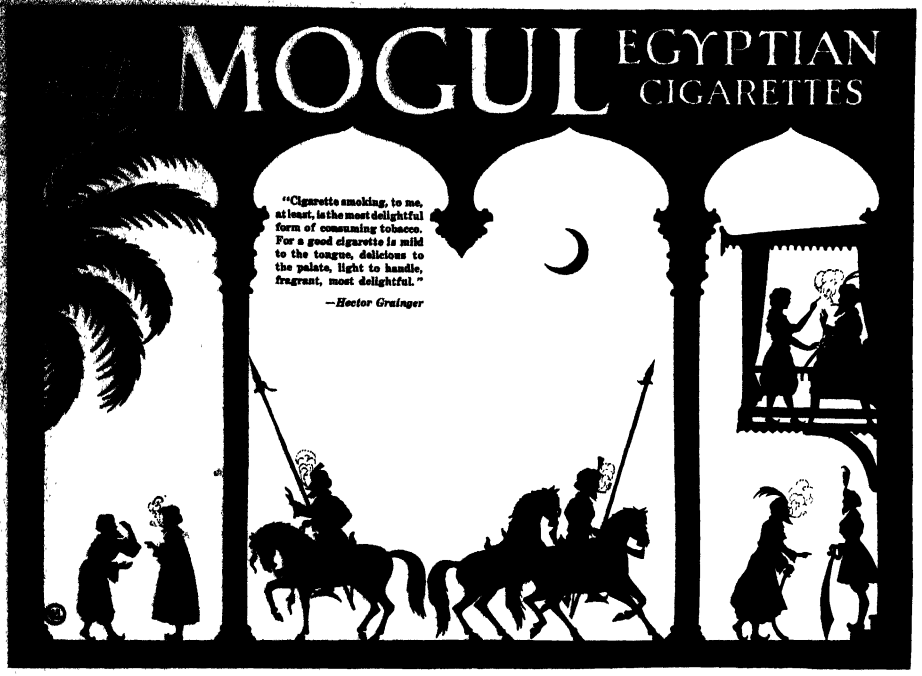
The storage tank of the installation is filled from an ordinary commercial drum, not by gravity, but by the pressure of the inert gas, and the process does not interfere with the discharge, either mechanically or on the score of danger. There is a fusible plug on the gas line both at the entrance valve and at the discharge valve, and in case of fire this plug, which melts at a low temperature, permits the release of gas, driving back the liquid to rest in the storage tank, where it is sealed from the access of air.

At the recent demonstration, in addition to the discharge of the electric spark in the storage tank, an ordinary shipping drum filled with gasoline was connected with the inlet valve of the installation. The gas was permitted access to the interior of the drum, forcing the gasoline into the fill pipe of the system so that there was no chance in the presence of the mixture of carbon dioxide gas and ordinary air for an explosion to occur, notwithstanding the fact that a strong wood fire was built around the drum sufficient to heat the drum to redness and to melt the lead pipe after the drum had been emptied. In other words, the drum became filled with the inert gas, while the gasoline was forced into the storage tank through the supply tube. A somewhat similar demonstration was made with the gasoline passing from the storage tank to the draw-off valve; the latter being open so that the gasoline flowing at full head could be ignited, while wood piled up around the pipes was blazing furiously. Notwithstanding the practical destruction of this part of the installation at the outlet valve, the main mechanism was not put out of operation and the storage tank, with its gasoline, was fully protected, as well as the system of piping. The gasoline stopped flowing after a few seconds had elapsed after the fire was started.

Naturally there are details and modifications in the system as above described in outline, but it has found wide application in Germany and in one installation in the business center of Berlin it is used to protect a storage capacity of 1,000,000 liters (250,000 gallons) of gasoline. For garages and other uses an interesting measuring device can be used, and in dry cleaning a special installation has been arranged which enables all but about three per cent of the naphtha employed in the process to be reclaimed, where formerly some 60 per cent was lost. In this process the water can be removed from the naphtha at various points of the process, and there are other advantages as well as increased safety. The accompanying photographs show the intensity and thoroughness of the recent test.

Rice Bran is a new commodity now being exported from Shanghai to the United States, according to a recent consular report. Until about two years ago, when shipments of it began to be made to Germany, rice bran was used by the Chinese as feed for animals or was neglected as waste; now the 10 mills in Shanghai from which it is obtained cannot supply the demand. It is fed to cattle, and also used as a fertilizer.

Electric Tuning Device for Wireless.—Patent No. 1,096,085 to Earl Glen Stalcaker of Chicago; Charles W. Stalnaker, guardian of minor, assignor to Charles W. Hoff of Chicago, presents a tuning device for a wireless telegraph system in which is provided an apparatus by which the inductance of a circuit or its static capacity, or both, may be varied to make the circuit responsive as more fully described in the patent.



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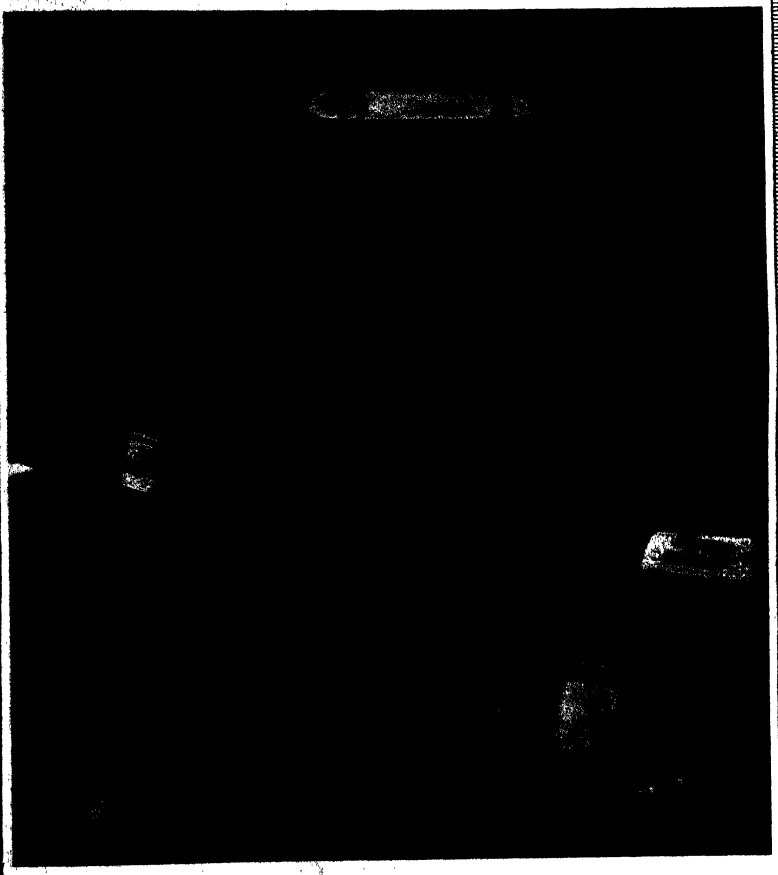
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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

A Perpetual Electric Current

IT is true of some discoveries—not of all—that after they are brought to light they seem almost self-evident. What must happen if an electric current is started, say by induction, in a closed circuit having a vanishingly small resistance? The energy is not dissipated as heat, since the heat produced is proportional to the resistance, in this case zero. There is no other obvious way in which energy would be dissipated, and the only conclusion left open to us seems to be that the current would continue indefinitely.

That this hypothetical case should actually have been realized must be a surprise even to anyone who may, at some time or other, have gone through the argument given above. Yet this is what has happened. Prof. Kammerlingh Onnes, the Dutch physicist, famous for his researches on low temperatures, has shown that several metals, when cooled to a definite temperature, low, but still above the absolute zero, cease to have any measurable resistance, and that a current started in a lead coil by induction continues indefinitely so long as the coil is kept cooled with boiling helium. Such a coil behaves like a permanent magnet, deflecting a magnet needle brought into its neighborhood. If the coil is connected up to a galvanometer there is an instantaneous deflection, and the current dies out in the circuit, which now includes a resistance.

In Prof. Kammerlingh Onnes's experiment a lead coil was used, which at room temperature had a resistance of 736 ohms. In liquid helium the resistance fell to less than a twenty-billionth of this, and the current was over one half ampere. At 6 degrees absolute there is a somewhat abrupt fall in the resistance of the lead, to practically zero. For each of several metals tested there is such a point. In the case of mercury it is 4.2 degrees, for tin it is 3.8 degrees absolute.

It had been the hope of physicists that very low temperatures would furnish us a means of producing very powerful magnetic fields, by the use of conductors cooled to very low resistance, and carrying large currents. But in this they have met with some disappointment. It has been found that when the cooled conductor is placed in a strong magnetic field, its resistance once more rises to a finite value.

Prof. Kammerlingh Onnes's discovery is, at any rate from the point of view of pure science, one of the most remarkable events in the progress of science during an epoch abounding with important developments. Whether it will have any direct practical application it is impossible to foresee at present, but indirectly, through the increase in our understanding of matter and electricity which is bound to follow from this discovery, there can be no doubt that many important material advantages will be gained.

Wilkes Land Up to Date

WRITING in the *Scottish Geographical Magazine* for June, 1912, Dr. W. S. Bruce, the well-known Scotch explorer and geographer, summarized the principal achievement of the Mawson Antarctic expedition by saying that it "has proved, over a distance of more or less 1,200 miles, the existence of Wilkes Land, which has been disputed during the *past seventy-two years*, and has set up stations at the west, and almost at the east end of it."

In this statement Dr. Bruce used the name "Wilkes Land" in its generally accepted sense, as designating the whole coast of the Antarctic continent lying between Victoria Land on the east and Kaiser Wilhelm Land on the west, or say from longitude 95 to longitude 160 east. The name is so defined in Lippincott's *Gazetteer*, in Meyers' *Konversations-Lexikon*, and in scores of other reference books of international standing. It has also been used in this sense on many British charts, dating back at least to 1866. Moreover, and what is more to the point, no rival name has ever been proposed for this coast as a whole, unless we except the name "Antarctic Continent," which Wilkes himself inscribed on the map of this region, but presumably without intending to imply that the "continent" was limited to the coast sighted by his expedition.

The propriety of giving Wilkes's name to this land need not be discussed here, and much less is it necessary to review the long-protracted disputes regarding the merits of Wilkes's discoveries, beyond saying that the Mawson expedition has certainly yielded much more accurate knowledge of the coast-line in question than was available a few years ago. The essential fact is that the name has been widely used for more than half a century, and cartographers who did not like it have never seen fit to replace it with another.

The only exception to the last statement that has come to our notice is a map published in *Nature* of March 5th, 1914, in which the name "Wilkes Land" is, indeed, printed in its proper place, but in type which may be most fittingly described as "evanescent," while in large, bold letters the new name "King George V Land" is spread over the same region.

Turning, now, to *Nature* of July 2nd, 1914, we find the first comprehensive published account of the Mawson expedition that has come from Mawson himself, in the form of an extract from a paper read by the explorer before the Royal Geographical Society. The paper contains the following statement: "The new land east of the Mertz Glacier we have received his Majesty's gracious permission to name King George V Land." From the context it appears that the Mertz Glacier, discovered by Mawson, lies somewhere about longitude 155 east; hence we find that Mawson had no idea of giving the name "King George V Land" to the whole coast explored by the two sections of his expedition, but merely to a comparatively small area lying just west of Victoria Land. The chart of March 5th, above mentioned, was, therefore, misleading in conveying the impression that the explorer had renamed a region that was named long before he was born; and the name "Wilkes Land," as applied to the whole coast, still remains without a competitor.

We regret, however, to learn that Sir Douglas has taken another method of removing this name from its time-honored place on the map—a method that was either ingenious or ingenuous, we cannot be sure which, though we strongly suspect the former. In describing Davis's westward voyage in the "Aurora" after leaving Mawson and the main party at Commonwealth Bay, he mentions that the vessel sailed over the charted position of land east of Wilkes's Cape Carr, finding no trace of land. He proceeds: "A few hours afterward, still steaming south, new land was sighted to the south—*icy* slopes rising from the sea similar to those of Adelie Land, but of greater elevation. To this discovery we gave the name of Wilkes Land, to commemorate the name of a navigator whose daring was never in question, though his judgment as to the actuality of *terra firma* was untrustworthy."

In other words, Wilkes Land, by the grace of Mawson, is a minor patch of coast of the same order of magnitude with Adelie Land, Clairie Land, Sabrina Land, and the numerous other "lands" which, collectively, constitute the Wilkes Land of yore! What next?

The Down-trodden Inventor

IN last week's issue of the SCIENTIFIC AMERICAN we referred to the autographic kodak invented by Mr. H. J. Gaisman—a camera attachment which makes it possible to write a caption or signature on a photographic film immediately after a picture is taken. Writers of novels who love to picture the weary and hopeless struggles of the inventive genius with grasping monopolists, who look upon a moneyed manufacturer as a fat spider craftily waiting in the center of his web to dart upon a foolishly adventurous fly of an inventor, will learn with disappointment that Mr. Gaisman—still so young that one would imagine him to have fallen a ready prey to the wiles of capitalists—has received $300,000 from the Eastman Company for his comparatively simple invention.

It is bad enough to have "romance" shattered in this way. But what shall be said of the company that pays this sum of money to make the inventor independent, to leave him free from all cares, so that he can devote himself whole-mindedly to his inventions? "I would have taken $10,000 for my work and would have jumped at $50,000," the inventor is reported to have said. But there was no haggling. Every possible expense which had been incurred was deliberately taken into account. First of all, there was the value of the inventor's time for the four years which he devoted to his device, for which a sum was set aside and then doubled, as an element in fixing the price. Then came the cost of the laboratory in which the invention worked. That, too, was doubled. And lastly, enough was added to make Mr. Gaisman independent.

Whenever we shall hear the story of the man who invented the ubiquitous monkey wrench and who lived to be buried by a few sympathetic friends, we shall tell the story of Gaisman and his autographic camera.

A National Seismological Service at Last

THE Agricultural Appropriation Bill, approved June 30th, 1914, grants to the Weather Bureau the authority that it has long sought to carry on investigations in seismology. Thus the United States falls in at the tail of the procession of countries in which the study and recording of earthquakes have been recognized to be as much incumbent upon a government as the recording and study of weather. The two fields of activity, while not closely related to each other in a scientific sense, are analogous in many respects, and the common custom of intrusting seismological work to a meteorological bureau is a measure of convenience. The Weather Bureau possesses about two hundred regular stations, well distributed over the country, and manned by paid observers who give all their time to the Bureau's work; also several hundred special stations at which the observers receive a small compensation for performing specified duties; and finally about forty-five hundred so-called "co-operative" stations, with unpaid observers. This Bureau is, therefore, ideally situated, as compared with other scientific bureaus of the Government, for inaugurating a system of instrumental and non-instrumental observations of earthquakes throughout the country without materially increasing its present operating expenses.

Several years ago the American Association for the Advancement of Science passed a resolution urging on Congress the plan of installing seismographs at a few of the more important Weather Bureau stations. Later a bill was introduced into Congress to establish a bureau of seismology under the Smithsonian Institution. Neither of these plans secured congressional sanction. Finally, in 1912, a decision of the Comptroller of the Treasury debarred the Weather Bureau from carrying on the work in seismology which it had undertaken on a modest scale without waiting for specific authority from Congress, and since that time the Bureau's unique seismograph, installed at its Washington office, has remained idle; i. e., its valuable records have been locked up in the Bureau's archives, instead of being communicated to the world. Fortunately this anomalous situation is now at an end.

It is understood that the Bureau has not funds for immediately undertaking instrumental observations of earthquakes on an extensive scale, but this will come in time. Meanwhile it is proposed to inaugurate at once a system of non-instrumental observations, so that the obvious features of sensible earthquakes will be recorded and promptly reported to headquarters. Thus it will be possible to locate the sections of the United States where seismic motion on existing fault lines is taking place with some frequency and regularity; a matter of great importance in connection with certain kinds of engineering works, especially those relating to great water supply projects or similar undertakings where it is necessary to provide against possible injury from earthquake movements. Perhaps the day is not far distant when the United States will possess a seismological organization comparable to that of the little empire of Japan, which includes more than fifteen hundred observing stations, at least seventy of which are equipped with modern recording apparatus.

The seismological work of the Weather Bureau has been placed under the supervision of Prof. W. J. Humphreys. The present chief of the Bureau, Prof. C. F. Marvin, is a seismologist of wide reputation.

The Variations of Daylight in Greenhouses and kindred phenomena have been investigated in a very thorough manner by Prof. G. E. Stone of Amherst, Mass. The measurements of light intensity were made with a form of chemical photometer, and are, therefore, applicable to the study of photolytic phenomena in plants. Prof. Stone found that morning light was, on an average, 10 per cent more intense than afternoon light. This difference varies with the season, in some months reaching 30 per cent. Hence, other things being equal, a crop will show a greater development on an east than a west exposure. The light-transmitting properties of different kinds of glass vary greatly. Thus the loss of light from glass as compared with outdoor light ranges all the way from 15 to 90 per cent or more. The practice of lapping the panes reduces an average loss of light of about 11 per cent. The transmission of light naturally increases as the angle of the roof more nearly coincides with a right angle to the sun's rays. The reflection of light from surfaces is another important factor.

Electricity

A Wireless Higher Than the Eiffel is in course of construction at Brussels and is designed for use as a wireless telegraph station, and for meteorological purposes. It will be 1,968 feet in height, while the height of the Eiffel Tower is 984 feet.

Electric Resistance of the Skin.—Prof. Von Pfungen is engaged with experiments in his laboratory at Vienna upon the resistance which the human skin affords to the electric current. He operates by passing the current through the body from one hand to the other and measuring the amount by a sensitive galvanometer. His researches bear upon the relation of the state of the nervous system to the electric resistance of the skin, and he claims that nervous excitement of any kind lowers the protecting power of the skin to quite a marked extent.

Resistance Alloy.—A new alloy for use in making electric resistance has been lately put on the market in Germany, and is said to be of great use in case the resistance wires or strips need to be worked at a high heat; for the new alloy of chromium and nickel can be run at even a bright red heat without suffering damage, and such heating does not make the metal brittle upon long use. Specific gravity of the alloy is 8.25, and it has a specific resistance per meter length and square millimeter section of 1.10 ohms. It can support a temperature of 1,110 deg. Cent. on constant run. The melting point is 1,400 deg. Cent.

A National Committee for Telegraphic Research.—A committee appointed by the Postmaster General of Great Britain recently recommended that a national committee for telegraphic research be established to promote the progress of telegraphy and telephony by theoretical investigation and experiment. It was also recommended that a national research laboratory be established with a special scientific staff. It was pointed out that both in Germany and in the United States a more liberal provision is made for research and experimental work in wireless telegraphy. In this country, the Navy, the Army Signal Corps and the Bureau of Standards cooperate in such work, while in Germany the work is carried out by the Post Office.

Electric Vehicle Day.—In order to give the public some idea of the extent to which electric vehicles are used it has been proposed that some day, preferably a holiday, be appointed as an electric vehicle day when, in the various centers throughout the country, there shall be a parade of electrically equipped vehicles, and prizes offered for the best decorated commercial and pleasure vehicle. The suggestion comes from Robert Montgomery, manager of the Louisville Gas & Electric Company. It is interesting to note that in England, at the recent Municipal Electrical Convention held in Birmingham, there was a parade of electrical vehicles which proved a decided success, and focused the attention of the public on the convenience of this newer type of motor vehicles.

Primary Battery Patent.—A recent French patent relates to a primary battery of the Leclanché type, in which the positive electrode uses a mixture of dioxide of manganese and graphite, but the new method replaces the graphite by lamp-black obtained from the decomposition of acetylene. When acted upon by an electric spark discharge, gaseous acetylene decomposes to hydrogen and carbon, thus giving a chemically pure carbon. Its density is only 0.9 while that of graphite is 2.17 to 2.20. In this way it is possible to increase the proportion of dioxide of manganese and obtain a more regular working of the cell than with natural graphite whose composition is variable. The finely divided state of the acetylene carbon also gives a more intimate mixture with the dioxide, and hence a better result. Another patent relates to a method of working batteries of the above type so as to use considerable current from them and at the same time not run the battery down. The inventor treats the usual dioxide and graphite mixture by adding to it an oxide of mercury, preferably red mercuric oxide, and in such case the output of the cell may be increased several times and the battery can thus give heavier currents than before, holding up the voltage at the same time. He still further strengthens the battery by using an alkaline electrolyte such as caustic soda or potash.

Deautized Electricity.—An interesting method of preventing the improper use of electric current has been devised by an Italian engineer. The practice of making especially low rates for current to be used in electric power, heating and cooking devices is becoming more and more general, but with the ordinary constant potential current it is difficult to detect the use of lighting devices on circuits intended only for power and heating purposes. This engineer advocates the use of special circuits on which the current is subject to extreme fluctuation of voltage at rapidly recurring intervals, which would make it practically impossible to use lamps, because of the flicker in the lights. As the current is not entirely interrupted and the normal voltage is almost immediately restored, the proper operation of power or heating apparatus is not interfered with and the rightful use of the circuits for their respective purposes is secured.

Science

A Rare Optical Phenomenon was observed by G. Isely at the Observatoire du Jorat, Switzerland, on March 12th, just after sunrise, when the sun was seen to be accompanied by two mock suns, one above and one below it, each at a distance of about 2 degrees from the luminary. This phenomenon is explained by Pernter as a form of mirage. The classical example of its occurrence is that described and drawn by Hevelius, in 1682. (The drawing is reproduced in the SCIENTIFIC AMERICAN SUPPLEMENT of November 16th, 1912, p. 309.)

Miners' Lungs.—It is well known that those engaged in occupations in which much silicious dust is produced (e. g., potters, certain miners, etc.), suffer from a form of lung disease. Dr. McCrae has analyzed the lungs of such cases occurring in the Witwatersrand mines in South Africa, and has published his results in the South African Institute for Medical Research. He finds that from 2.8 to 9.6 grammes of silicon may be present, compared with 0.55 gramme in a normal lung. Microscopical examination of the silicious particles showed them to be angular, and the majority had a very small diameter.

The Corrosion of Aluminium.—Recent researches prove that aluminium is subject to two kinds of corrosion: one of these resulting from a uniform attack all over the surface, while the other is localized in scales and spots. It is to be noted that the second case is generally produced upon metal which is mechanically worked by drawing or rolling. As in the case of iron, it seems that the metal must be exposed to air and dampness at the same time, for one alone will not produce it. Carbonic acid is a leading element in the corrosion. Worked aluminium scales off in the direction in which the mechanical action has been carried out.

Henri Poincaré.—Prof. Mittag-Leffler has taken the initiative in starting an international subscription for the striking of a medal bearing the effigy of Henri Poincaré, of the famous French mathematician, lately deceased. Gaston Darboux, in order to perpetuate the memory of the great mathematician, has proposed the foundation of a prize to be awarded by the Académie des Sciences to young mathematicians. A committee has been constituted which counts among its members the chief notabilities of Science, Letters and Politics. Subscriptions are received by Paul Appell, Etienne Lamy and Gaston Darboux. The treasurer is M. Ernest Lebon, 4 bis, rue des Ecoles, Paris.

A New Method of Setting a Mercury Surface to a required height, as, for example, in setting a mercurial barometer with adjustable cistern, is described by M. H. Stillman, in a publication of the Bureau of Standards. The ordinary method of setting a barometer is to screw up the cistern until the ivory point representing zero of the scale makes a visible dimple in the surface of the mercury. The improved method consists in placing a parallel-ruled scale back of the pointer, so that its image will appear reflected on the surface of the mercury. The slightest contact of the pointer with this surface will cause the lines of the image to become distorted, and thus a very delicate adjustment of the instrument is possible.

Microbes in Humid Air.—According to the researches of Messrs. Trillat and Fouassier, published by the Académie des Sciences, microbes suspended in the air act as centers of condensation, when the air is humid. The authors give evidence of the existence of microbian drops in the atmosphere and they have studied their properties. One very interesting result is that the sudden cooling of the atmosphere has the effect of transporting the microbes and localizing them in determinate regions. The cool surfaces attract them from a distance almost instantaneously, the smaller being transported farther. These new ideas throw light upon the genesis of certain epidemics, and may be useful in planning the distribution of inhabited places.

Destroying Locusts in Turkestan.—A remarkably successful campaign has recently been conducted by the Russian government against locusts in Turkestan, where formerly the inhabitants, for religious reasons, did hardly anything to check the ravages of these insects. Turkestan supplies almost half the cotton used in Russian mills, and raises other valuable crops. As recently as 1901, locusts caused an annual loss of over $2,000,000 in this region, and only primitive methods of dealing with them were in vogue. The loss has now been reduced to practically nothing. The methods employed by the Russians include: (1) preparation in summer and autumn of forecast maps, showing the position, area and density of the egg centers of each district; (2) treatment of the infested areas with Paris green, or, better, molassed sodium arsenite, as soon as the larvæ appear; (3) scorching by knapsack machines of larvæ in places not accessible to sprayers, devoid of vegetation, or far from water-courses of sufficient capacity to keep the sprayers going; (4) capture of larvæ in pits or ditches. Breeding of parasites on a large scale for use in destroying locusts has not yet been attempted in Turkestan, though experiments in this direction are in progress.

Astronomy

Diurnal Variations in Latitude.—From observations made at Pino Torinese, by Boccardi, following the method of Struve, which was applied by utilizing four stars which could be obtained even in the day time, it appears that there are diurnal variations in latitude. The maxima and minima follow the movements of the moon, which seems to demonstrate its action.

The Proposed Reconstruction of the Mont Blanc Observatory.—The observatory which occupies the summit of Mont Blanc and which was constructed by Janssen is now entirely buried under ice, and it is desired to rebuild it. To this end, the Mont Blanc Observatory Society held a recent meeting at the Paris Institute, in order to consider the question. A report was read by M. Vallot, chief of the enterprise, and a commission was appointed for the purpose consisting of the three astronomers, Hamy, Puiseux and Stefanick, also M. Vallot, the eminent astronomer, and Dr. Bayeux, a physiologist well known for his numerous researches made upon Mont Blanc. These scientists propose to make an ascension to the summit of the mountain during this summer, in order to determine the conditions of re-installing the observatory. Mlle. Janssen, who is the daughter of the deceased scientist and who is continuing her father's work, was present on this occasion, and also Prince Roland Bonaparte and many eminent scientists.

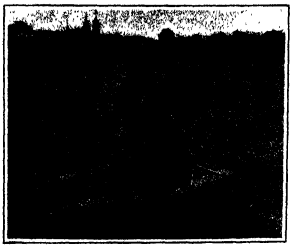
Radial Velocities of One Hundred Stars with Measured Parallaxes.—Messrs. W. S. Adams and Arnold Kohlschutter contribute a paper to the *Astrophysical Journal* relative to the radial velocity determinations during the past three years of stars fainter than magnitude 5.5 on the visual scale for which observations of parallax are available. The photographs were secured with the 60-inch reflector in conjunction with the Cassegrain spectrograph adapted for use with one prism, but for stars from 5.5 to 6.5 magnitude a camera lens of 102 centimeters focal length was used, while for stars fainter than 6.5 a lens of 46 centimeters focal length was employed. Briefly summarizing some of the conclusions derived from this excellent piece of research work, the first to be mentioned is the enormous radial velocities of a few of the stars observed. Thus two indicated velocities of —325 and —242 kilometers, the first of these being the highest recorded radial velocity among any of the stars. Four other stars exceeded 100 kilometers, and several between 75 and 100 kilometers. A notable fact is the great preponderance of large negative over large positive velocities, no less than 75 per cent of the large velocities being negative.

The Light of Stars.—The March number of *Le Radium* contains a paper by Dr. A. H. Pfund, of Johns Hopkins University, in which he describes some preliminary tests he has made of a new apparatus for measuring the light of a star. The work was done at the Allegheny Observatory, the Keeler 30-inch reflector being used. In the focus of the telescope, either of two small blackened disks which formed the junction of a thermo-circuit could be placed. The wires used for the thermo-element were alloys of bismuth and tin, and of antimony and bismuth, respectively. They were enclosed in an evacuated capsule closed at one end by a plate of fluorite and substituted for the eye-piece of the telescope. The thermo-current was measured by a moving-coil galvanometer. The sensitiveness of the arrangement was such that a candle at a distance of eight miles would give a deflection of one millimeter. The deflections obtained from celestial objects were: Vega, 7.5; Jupiter, 3.0; Altair, 2.0 millimeters. The author hopes, by using a more sensitive galvanometer and other materials for his thermo-elements, to increase the sensitiveness considerably, and in this way to open up a new field of astrophysical research.

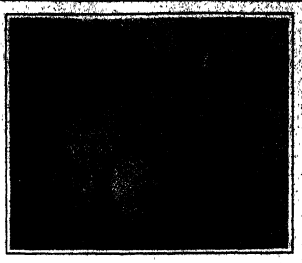
The World's Large Telescopes.—In a recent number of the *Observatory*, Mr. H. P. Hollis gives a very interesting list of large refractors and reflectors, either under construction or already set up in observatories. The largest working objective is that of the Yerkes Observatory in Wisconsin, U. S. A. Of the refractors under construction, the following may be mentioned: a 32-inch for the Nicolaieff Observatory, Russia; a 26-inch for the Union Observatory, Johannesburg; three 24-inch for the following observatories: Argentine National Observatory, Cordoba, Chili National Observatory, Santiago, and the Detroit Observatory, Mich., U. S. A., and a 20-inch for the Chabot Observatory, Oakland, Cal. The Earl of Ross's 72-inch reflector holds the field for the largest reflector (metallic speculum), while Dr. Common's 60-inch (silver on glass), now at the Harvard Observatory, U. S. A., comes second. Of the reflectors under construction, two giants are in hand, namely, one of 100 inches for the Mount Wilson Solar Observatory, and one of 72 inches for the Dominion Observatory, Canada. Others under construction are a 40-inch for the Simeis Observatory, Crimea, and two of 30 inches, one for the Helwan Observatory, Egypt, and the other for Mr. D'Esterre's Observatory, Surrey, England. It is interesting to note that the number of instruments in each list is about the same, namely, 38 refractors and 40 reflectors.

Watercycle Races

A Curious Contest That Took Place at Enghien-les-Bains



Dugeil's watercycle.

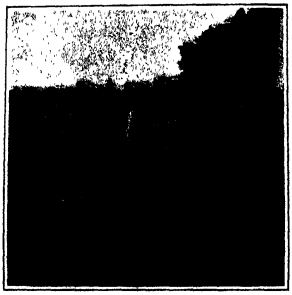


The Schweitzer rolling hydropied.

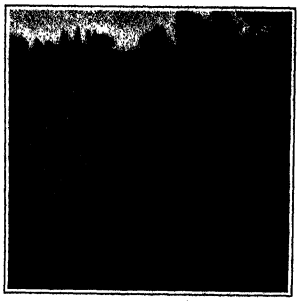
A NOVEL series of races, of which we are able to give our readers some interesting pictures, was held on the afternoon of June 14th at Enghien-les-Bains, a suburb of Paris. These races were a contest between various forms of water-cycles on the little lake of the town. The meet was arranged by the Parisian newspaper *L'Auto* with the aid of the management of the springs and of the boat club of Enghien. They proved so great a success, some 20,000 spectators being present, that other meets are planned. Thirty of the thirty-eight machines entered for the races appeared on the day set. These machines were divided into seven classes: 1, Machines on floats with propellers under water; 2, machines on floats with aerial propellers; 3, boats with hand or foot-operated propellers under water; 4, boats driven by hand-operated aerial propellers; 5, miscellaneous machines with propellers under water; 6, miscellaneous machines with aerial propellers; 7, machines of various constructions.

The programme of the races was as follows: At 2:30 P. M. a parade around the course, in which all contestants took

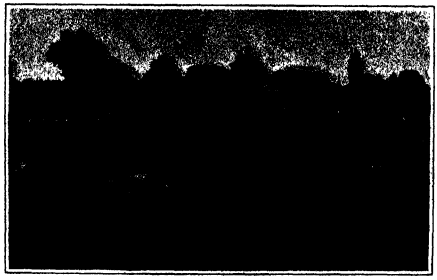
(Concluded on page 68.)



Taillieu, winner in the seventh class.



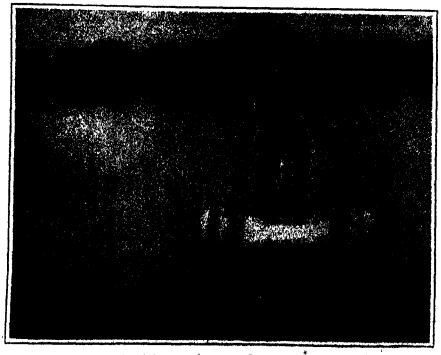
The Deguet apparatus.



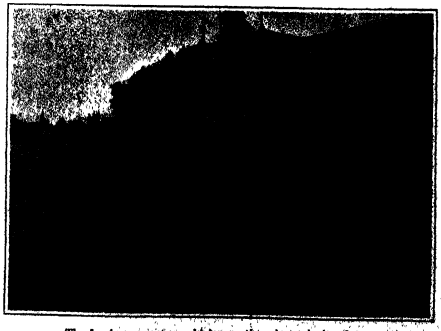
The watercycle race which was held on the Lac d'Enghien, near Paris, on June 14th, 1914.



Deguet hauling a pleasure party.



The Schweitzer hydropied from the rear. It was driven by an air propeller.



The Louis apparatus, which was the winner in its class.

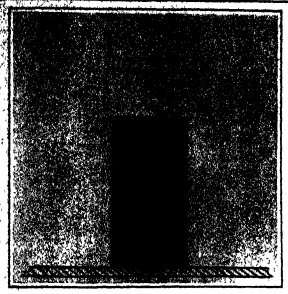


Fig. 1.—Sea focal plate for ascertaining momentary direction of translation.

Steering Air Craft at Sea

Some of the Difficulties of a Transatlantic Flight

By the Staff Correspondent of the Scientific American at Hammondsport

Photographs of Lieut. Porte's instruments by F. J. Weyman.

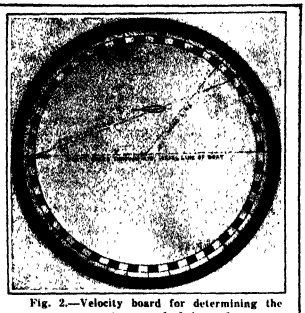


Fig. 2.—Velocity board for determining the momentary speed of the craft.

THE general art of piloting air craft, buoyant and unbuoyant, involves manifold tasks requiring manipulative skill, experience, and technical knowledge. The pilot, or his aid or crew, must keep the craft in structural and running adjustment; must maintain her poise and evenness of travel; must choose the most favorable air stream and altitude; must avoid perilous or impossible conditions; must navigate geographically, that is, determine the geographical position, and direct the course.

The geographical navigation of air craft without a map—the subject of the present inquiry—is of especial interest now, because of the approaching transatlantic flight. As applied to ocean flying it presents three questions: how to steer when only the sea is visible; when only the firmament is visible; when neither is visible. We may omit the case in which both sea and sky are clear, as this is but a combination of the first and second cases.

To be more specific we shall assume that the pilot is seated beside a qualified aviator, in a closed flying-boat with suitable windows, and provided with navigating instruments of his own choosing. He will want instruments for determining his boat's orientation, inclination, altitude, speed through air, momentary direction and speed over the water, hourly position on the globe, and hence the hourly course and speed, besides auxiliary instruments, such as a clock, hydrographic chart, weather instruments, astronomical and trigonometric tables, etc.

Determining the Direction of the Course.

The flying-boat's orientation referred to the earth's magnetic meridian, and thence, by chart or table, referred to the earth's meridian, can be determined by the ordinary mariner's compass. This can be read either by looking down upon its level face, or by looking horizontally into an inclined mirror or a prism. As the poise and motion of the boat can usually be kept quite steady the magnetic compass can be read truly to one half a degree. A specially light gyroscopic compass also may be used to indicate the true north independently of the earth's magnetism.

Measuring the Dip of a Machine.

The dip and tilt of the aeroplane can be measured with an inclinometer. A spirit level serves very well, especially for the more even conditions of the air at sea. When the billows or swells increase, the poise cannot, near the ocean surface, be maintained even, and hence can not be so accurately determined. An increase of altitude gives an evener poise, and will naturally be taken when the wind blows approximately with the vessel. In fair conditions the inclination can, with such a spirit level, be maintained and measured truly to a fraction of one degree, at least for a brief period of time. A short damped pendulum with a long pointer is also accurate, but less simple in structure.

Altitude Indicators.

The altitude of flight, when very small, can be measured with a plumb-line or an optical range finder; when great, with a barometer or barograph. When the sea is very smooth the plumb-line measurement may be made accurately to within less than a yard in one hundred feet; when quite rough the height cannot be measured accurately by any known method. The altitude may be satisfactorily determined with an aneroid barometer if the sea level pressure be first measured, and if the barometer readings be not vitiated by the rush of air past the barometer case. Means have been devised for obviating or minimizing errors from this source.[1]

Determining the Speed of the Craft.

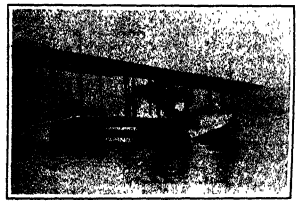
The speed of the boat through the air can be measured with anemometers of various types, as the screw, the revolving cup instrument, the wind-tube, the pressure plate, and numerous other kinds. All, however, must be placed and used with some skill. It is important that they measure the speed of the undisturbed air at some distance from the hull, unless, by special calibration, errors due to local modification of the general air speed can be obviated. If the shaft of the screw or cup anemometer have its outer end well away from the hull, and before the wings and propellers, while its inner end connects with a rotation counter, or common "speed indicator," or a very good tachometer, the number of turns per minute can be read truly to one per cent, and the speed of the undisturbed air flow past the craft can be measured with like precision. It is well to calibrate such instruments, in their working positions, by actual flight through air for a known distance, or by comparison with standardizing instruments. The wind-tube may be either a Venturi air tube calibrated by trial, or a coaxial wind-tube. The latter is sometimes, though erroneously, called a Pitot tube. It consists of an inner tube pointing its open end into the wind, an outer coaxial tube having a series of side holes around it, well back from the point, and a manometer and connecting hose for measuring the difference of pressure in the two tubes. From this pressure difference the air speed is calculated in terms of the air density, which must be known or found, say from the observed temperature, barometric pressure and humidity. If the density be neglected, an error of several per cent in the speed may be made; in fact, an error of about one per cent for each 5 deg. Fahr. change of temperature, and each three tenths of an inch change of the barometric height.

The pressure plate anemometer receives the impact of the air, and by the force of this duly indicated or recorded, shows the air speed in terms of the density. All such impact instruments, or "pressure anemometers," after collecting the air pressure, require that it be measured, then that the speed be determined from the density, either by calculation or by use of tables. For accurate use they are not ready instruments; for ready use they are less accurate than the "velocity anemometers," such as the screw or the rotating cups, etc. These, after calibration, require only that their angular velocity be taken, either with an instantaneous tachometer or with a speedometer and stop watch.

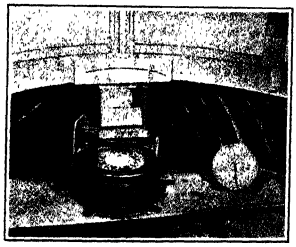
An aerial log line, consisting of a toy balloon and thread unwinding from a reel may be used, sailor-wise, to measure the speed of the flying-boat, or to calibrate other anemometers. A Crocco anemometer also could be used to standardize others more convenient for practical navigation.

How the Direction of Translation is Ascertained.

The momentary geographical direction of translation of the craft over the ocean surface, regarded as stationary, may be determined by noticing the apparent line of transit of wavelets or floating objects past the boat, or across the field of an optical instrument therein, such as a camera or telescope. Such passing objects will appear to describe streaks or stripes along the focal plane, especially if the focal length of the objective and the height above the water be so chosen as to cause the images to cross the optical field quickly. If the objects have but slight speed across course, say one per cent of the boat's speed on her course, the resulting deviation of the stripes may be neglected. By sunlight the distinct objects on the ocean surface, more especially white caps, are usually numerous; by night luminous objects may be projected on to the water, preferably ahead of the aeroplane, and along its true course. Wooden balls coated with potassium will flash on striking the water. Sodium-tailed arrows or flaming torches, cast quickly upon the ocean face and remaining bright for a few seconds, may be used to sight back to, and thus indicate the course as compared with a compass needle. Under favorable conditions, the direction may thus be determined to about one degree. Whatever the visible object, if its image cross the plate quickly, say in one tenth of a second, it will appear as a stripe or streak all across, and may be



Preparing to test the side floats.



Fore part of "America's" cabin, showing compass, etc.

At left end of shelf is a bar magnet to correct deviation of needle due to iron and steel in airboat. Their compass was brought from England by Capt. C. Osborne, R.N. Note the hinged celluloid cabin windows above the instrument.



Stroboscope suggested for finding the speed of sea's image across a ground glass, to serve in estimating the overseas speed of the airboat.

[1] Rahm, Measurement of the True Pressure in a Moving Fluid, Jour. Frank. Inst., 1913.

determined in direction by comparison with an adjustable line or lines of reference; if it cross slowly its position on entering and leaving the field may be noticed, thus giving the direction approximately.

Practically a lens may be inserted in the bottom of the hull and bring the sea's image to focus on a level ground glass or celluloid plate above it, or on a vertical or oblique plate if an oblique mirror be inserted between the lens and the image plate. Reference lines and a graduated arc on the plate may serve to measure the direction of travel referred to the boat's axis or the needle of a compass. The compass needle can be mounted just under the focal plate, if this be level, or reflected upon it if oblique or vertical.

For example, in Fig. 1 the lens *L* may bring the sea face to focus on the frosted plate *A*, preferably turnable in its plane and circularly graduated, while the compass needle is supported just beneath on a transparent plate. Again, the light from the same lens may be reflected by a mirror to focus on a vertical plate, while another lens may bring a compass needle to focus on the same vertical plate, by reflection from a transparent mirror placed before the other one.

The Speed at Any Given Moment.

The momentary speed of the flying-boat over the water may be determined in many ways. If her altitude be unknown, or disregarded, her speed over the water, and incidentally the wind speed, may be found as shown in Fig. 2. The speed *V* of the boat through air and her inclination α to her over-sea course are read; then she is turned into the wind line, or so that wavelets seem to move fore and aft, and the angle β of her turn is noted on the compass. From these three observations a triangle is determined giving the over-water speed of the boat, and incidentally the true wind speed. To simplify the process, transparent millimeter scales pivoted at the ends of *V* in the diagram can be set at the angles α, β, and read at their crossing to give, in terms of *V*, the over-water speed of wind and boat. Thus if *V* be 100 millimeters, and 40 be read on the wind scale at the crossing, the wind speed is 40 per cent of the boat's observed speed through air. The scales can be read truly to less than one per cent; the speed *V* to one per cent, more or less, the angles α, β, to about one degree. Hence the over-sea velocities of boat and wind can be determined to a corresponding degree of accuracy. The graduated disk and pivoted scales constitute in fact a mechanical device for solving any case of plane triangles, without the aid of trigonometry.

If the boat's altitude be known, her over-water speed may be found from the speed of the ocean's image moving across the field in an optical instrument, say a camera or telescope, or the sea focal plate just described, which, with the keel lens, is the equivalent of a camera. If this plate be large, and the altitude of flight be considerable, the period of transit of the image of a well-defined sea object can be taken with a stop-watch truly to one or two per cent. On a horizontal image plate the image speed is constant if the over-sea speed be constant. Hence the speed of travel of the image, multiplied by the ratio of the distances respectively from lens to sea and from lens to plate, gives the boat's over-sea speed. This ratio may be made some easy multiplier, say 100, by suitably adjusting those two lens distances. If the angular displacement through 45 degrees be taken with a rotating telescope or camera, and timed with a stop-watch, the over-sea velocity equals the boat's altitude divided by the observed time.

If, however, the sea's image crosses the plate or field of view too quickly, its speed cannot be found by a stop-watch. In this case two optical methods are available to find the over-sea speed of the boat; either halting the image, or diverting its course. To halt the image, it may be viewed either through a stroboscope or in a mirror rotating backward or in a like rotating telescope, to divert the image, the said rotation may occur perpendicularly to the path of the image, so that its lateral speed may be proportional to its direct speed, thus making the image travel at an angle to its natural course across the plate. The speed of telescope rotation, or half the speed of mirror rotation, that causes either halting of the image or diversion through 45 degrees, has only to be multiplied by the altitude of the boat to give the over-sea speed.

If the ocean face be too thickly fogged, the foregoing methods are unavailable to determine the over-water speed of either the boat or the wind. In this case, by flying moderately low, a light log line can be dropped into the sea and paid out while trailing due fore and aft of the boat temporarily turned into the wind line.* Thus observations of the log line and compass give the boat's over-sea velocity in the line of the wind. From this and the observed speed through air, the navigator, by using the velocity board, shown in Fig. 2, can immediately turn the boat to her desired course, and read off her over-sea speed along this course, sailed though it be in fog or darkness. Also from the tracings of a pressure plate anemograph, which shows greater pulsations of speed in the wind line than when traveling across wind, and proportionately greater pulsations as the wind increases, it is claimed that the speed and direction of the wind can be judged even in the dark. But this claim is mentioned more for its novelty than for its validity.

* If the over-water course be oblique to the wind line, the log line tends to trail fore and aft, due to the air rush past the boat. A fine wire trailing from a low flying-boat, with good water drag, tends to indicate the true course over water even when flying obliquely to the wind.

Finding the Hourly Speed and Course.

The hourly speed and course can be found by astronomical means familiar to the marine navigator. The pilot can, with his watch and sextant, read respectively the time of day and the altitude of two heavenly bodies, say the pole star and another one, and from these data, by aid of his astronomical tables, he can determine his geographic position, i. e., his latitude and longitude. The change of position from hour to hour determines his course and hourly speed.

In practice several devices are available for finding the altitude or the zenith distance of a heavenly body. If the sea be clear the sextant's telescope, held freely in hand, is pointed straight at the horizon, while the angular distance of the heavenly body is measured with the sextant index. Ordinary swaying of the craft will not thwart this. In case the flight be moderately high, a correction can be made for the consequent depression of the horizon; if very high, the horizon blurs or disappears. With a clear horizon, an expert navigator can, it is claimed, thus locate his position on the globe truly to one mile or one minute of arc.

Another device is to use an artificial horizon. Astronomers measure the angle between the star and its image reflected from the surface of still mercury, and divide by two to get the true altitude. This method is available on land at any elevation and without clearness of horizon. To apply it in an air craft the mercury would have to be supported so as to remain level and smooth. In lieu of mercury a rigid plane reflector kept horizontal may be used, say a polished plate floating on a liquid, or supported on gimbals. Also a polished plate fixed to the aeroplane frame and kept level for the moment by the aviator, who can usually choose a favorable atmosphere several times a day, and hold his craft level to within less than one degree by means of the controls and inclinometers.† If the image of the star sway to and fro a degree or so during this leveling of the craft, the navigator can take the mean position, as is done in scores of laboratory instruments. Greater accuracy, however, is claimed for the sextant and plumb-line. By this combination experienced seamen claim to be able to locate their position truly to three miles, or three minutes of arc.

A third device is to focus the sky on a graduated chart kept horizontal and having its center vertically under the lens, fixed say in the top of the cabin. During the moment that the aviator holds the craft level, the zenith star or point of the sky can be focused on the center of the chart, and the other stars will have their images at distances from the chart center or zenith image, which are measurable on the chart itself by suitable graduations. The chart can be either plane or spherical, say concave upward like a dish, and the graduations for zenith distance can be made accordingly. If the center of the plane or concave chart be called the pole, lines radiating from it mark the longitude referred to it; circles about the pole space off the latitude. The positions of any two stars on this chart, preferably at some distance from the zenith, enable the navigator, by use of his watch and tables, to determine his true geographical position. The sea image plate already described, if suitably enlarged, may serve for the plane sky chart here considered, provided the sky lens be chosen of the right focal length. To obviate the need of holding the aeroplane level, the chart and lens can be rigidly mounted on a frame supported so as to maintain their proper poise automatically, or steadied by the observer with spirit levels. Instead of reading the star's position on the chart it may be recorded on a sensitive photographic plate or film graduated by photography or otherwise. The altitude of the sun and moon can be taken instantaneously. The star's record may require a large lens and considerable exposure; but there is little objection to a long exposure if the craft be kept from turning, or if the shutter be closed during undue oscillations, provided allowance be made for the drift of the image due to the earth's rotation. Thus, during a minute's exposure the star and its image travel one quarter of a degree due to the earth's rotation, and about 1/69 of a degree due to the boat's over-sea speed, if this be one statute mile per minute. The images of several bright stars can also be marked on the chart with a pencil, so that their zenith distance can be read at leisure. If, for example, the focal length of the sky lens be 57 inches or centimeters, the degree measured on a concave chart is one inch or one centimeter; so that if the chart be held level to a fraction of one degree, the zenith distance of the star can easily be read to a fraction of one degree.

† It is still an open question as to how nearly dead level an aeroplane can be held for a brief time, say half a minute, in smooth air.

In case the sky be long obscured, the pilot may compute his position from his instrument record of speed and direction since last taking his position, with the sextant. An excellent method, if applied without excessive weight, would be to use two gyroscopic compasses inclined to one another, say one on parallels, the other perpendicular to the earth's axis; the first indicating the true north and the latitude, the second indicating the longitude. The pilot, plotting his course from frequent readings of this apparatus, would have a good indication of his average momentary progress over sea, and thence could correct his steering, or find the average wind velocity by use of the velocity board already explained. The ordinary gyrostatic compass is graduated to single degrees and may be read to about one quarter of a degree, or 15 nautical miles. Such a check on the drifting of air craft at sea would, in the present state of the art, be very satisfactory, and especially in fog and darkness. Determinations of position by wireless, as practised in Germany, or by report from passing ships, may be disregarded here.

Unaided observation of the waves enables an experienced navigator to judge the speed and course of the wind to a degree of accuracy not despised by sailors. The well-known Beaufort scale of wind speeds is based on this principle. It is a primitive way of estimating the wind velocity, but may, when the wind is light, enable the air navigator to steer without greatly increased length of course. A good sailor can, by inspection of the waves, judge the direction of the wind truly to within ten degrees, and its speed truly to 30 per cent. With equal or greater accuracy the skilled aviator can judge his over-sea direction and speed by mere inspection of the passing water near at hand.

The effect of errors in steering may be minimized by timely correction. If in sailing from *A* for *B* one really follows the course *A C*, making a small angle with the true course, say 5 to 10 degrees, no serious increase of course ensues, provided the departure be corrected well before *B* is approached. The hypotenuse of a plane triangle is half of one per cent longer than the base, if the angle between them is 5 degrees; 1½ per cent longer if the angle be 10 degrees. The main objection to such errors of direction is the missing of the port, or place aimed at, rather than the lengthening of the course. But if the geographical position can be determined truly, the navigator can always correct his defects of steering, and finally arrive near his goal. One degree error on a great circle is a linear error of 60 nautical miles, or about 69 land miles. Hence, if the navigator is sailing for a large conspicuous coast, he need not miss it because of an error even so great as one degree in taking the stars, nor very materially lengthen his course by an error of 5 to 10 degrees in steering, more especially if he has merely to reach the coast and not any specified point thereon.

As we have seen, the errors in direction when steering with the compass, aided by instruments for estimation of wind velocity, can, under fair conditions, be kept well under 5 or 10 degrees. Suppose, however, that the wind be judged by the eye alone; say the speed truly to 30 per cent, the direction truly to 10 per cent: what then is the likely range of error in steering by compass an air craft having a natural speed of 60 miles an hour? As a particular case, suppose a wind of 20 miles an hour blow squarely across her desired course. The pilot, misjudging the wind speed by 30 per cent, will think it 6 miles faster or slower than it really is. When he has pointed his course to the best of his ability he will be advancing toward his goal at 60 miles an hour and drifting sidewise 6 miles an hour. The error in steering is thus an angle whose tangent is one tenth or an angle of 5¾ degrees. The lengthening of course due to this error is about one half of one per cent, and the drift off course about 60 miles in a voyage of 600 miles. If the whole direct course be 1,200 miles, and no correction for drift be made during the first half of the voyage, this half is lengthened out by the error to the extent of about half a per cent of 600 miles, or about three miles.

From the foregoing discussion of the navigating devices and of the consequences of error in steering, it appears that no grave evil is to be expected from steering over any length of sea course terminating on a liberal coast line, say of 2 degrees, or 120 nautical miles, provided that a powerful and long sustained storm be not encountered. For example, in the proposed flight of Lieut. Porte and Mr. Hallet from Newfoundland to the Azores, an habitual error of half a point, or 5½ degrees, corrected by the heavens from time to time, would entail an increase of course of about six miles, or an increased consumption of fuel of 6 pounds. This is small compared with the increase of load that may be had from slight improvements of design. For example, an increase of one per cent in the propeller thrust means an increase of 50 pounds in the useful load.

Lieut. Porte's instruments and methods of navigating

have not all been made public, if indeed they have all been fully and finally decided upon. He has, however, announced that he will have a sextant, a mariner's magnetic compass, tables for solar and sidereal time, an chronometer for measuring his speed through air, and possibly an instrument for giving his instantaneous or momentary speed and direction over water. The latter, commonly called a "drift instrument," is of considerable importance, as it enables him to allow for the wind in laying his course. He expects also to secure from passing ships information as to their momentary distance from his proper course, to be conveyed by special flag signals according to a prearranged code. In case of need, carrier pigeons and rockets will be used to convey information, or to call for assistance.

Further Changes in the "America's" Bottom

By Our Staff Correspondent at Hammondsport

WHEN Mr. Curtiss, by use of the planing fins devised by himself and Dr. Kahn, and described in the SCIENTIFIC AMERICAN of July 18th, had made the "America" leap bodily out of the water at less than 20 miles an hour, he suddenly halted that promising series of experiments. He did not, as originally planned, proceed to make the angles of the planing fins adjustable, so as to regulate at will the amount of lift; but, yielding to the urgence of Lieut. Porte, he reverted to the pontoons, so as to secure greater flotation and possibly a stancher construction. The lieutenant was positive that large flat floats, lashed to either side the "America's" hull, must enable her to plane and rise promptly from the water with the desired 5,000 pounds total weight. From the data so obtained, the hull could be remodeled quickly to a compact, efficient form, and sent without further delay to Newfoundland.

Accordingly the pontoons of the Langley machine, which measure each 10 feet long by 3 feet wide by 10 inches deep, were lashed to either side the bow, flush with the bottom. But, though they had enabled the "America" to carry her largest load previously, when under the middle of the lower plane, they now gave much less lift, owing perhaps to the disturbed state of the water about the bow. They were at once replaced by larger pontoons, each measuring 13 feet long by 3 feet wide by 16 inches deep, lashed firmly to either side the bow and nearly flush with its outer bottom edge, being a trifle higher. The craft, so equipped, failed to rise with two men at first; then, after careful adjustment and trial, she planed well over the water, but would not lift so well as she had previously done with the smaller Langley floats under the middle of the lower plane. The big pontoons beside the bow were then discarded as being neither efficient nor promising.

In the meantime Mr. Curtiss, with little faith in the big pontoons, was studying and planning new varieties of planing boards. The most promising of these was an inverted V bottom fixed under the boat of the "America," and measuring about 16 feet fore and aft by 7½ feet wide between its parallel bottom edges. The sides of this inverted V bottom were steep under the prow, but practically horizontal under the step at the rear. This arrangement of the planing surface is known as the sea sled, and has the merit of gathering the bow wave underneath it and riding on the same, while throwing little water off at the sides. When properly rounded upward at the front it further tends to damp the pitching of the craft. Trials made with the sea-sled secured by encouraging hint that the hull of the "America" will be remodeled by the sea-sled bottom. Then the trials at Hammondsport will be virtually finished.

In the first trial of the sea sled bottom the airboat rose quickly to the water surface and planed neatly, with its load of three men, Mr. Curtiss, Lieut. Porte, and Mr. Hallet. When skimming on her heel, or step, she showed a tendency to nose forward and scoop water, a tendency not difficult to correct. The men returned smiling, and with evident confidence in the future of this type of planing board.

Phosphorescent Air Craft

NIGHT flying is now indulged in so systematically by military officers that the European governments have cast about for some means of guiding airmen As might be expected, the Germans were the first to attack the problem and to offer a practical solution Many of the more important military flying grounds of the German Empire are now provided with aerial lighthouses —beacons which are analogous in function to the lights which guide the mariner when he nears land Each German beacon has its characteristic flash, so that the airman may know a particular lighthouse by its flash The vision which Kipling presented in his "Night Mail" —a vision of a planet studded with queer structures which send out intermittent flashes or sweep the sky with long, finger-like searchlights—is in a measure realized only ten years after aviation became a reality

The German system of employing lighthouses and searchlights, efficient though it is, is undeniably expensive It involves the construction of suitable towers, the installation of lighting apparatus, and the maintenance of a staff of lighthouse keepers. In a most interesting lecture which was recently delivered before the Aeronautical Society of New York, Mr William J Hammer expressed the opinion that phosphorescent paint might be used with great advantage for the same purpose.

Now ordinary phosphorescent paints, consisting chiefly of calcium sulphide contained in various vehicles, such as linseed oil, are not well adapted for the purpose. They give a ghastly greenish blue. There must be some means of varying the color of the luminous paint which is employed—a means which it has remained for Mr. Hammer to discover.

To be sure, it is possible to number machines or to apply even the ordinary calcium sulphide luminous paint in characteristic patterns. But a machine thus adorned would have to approach very closely indeed before it could be recognized. What is obviously wanted is a method of making phosphorus paint in different colors.

Before we can explain how Mr. Hammer has succeeded in attaining this result, we must clearly keep in mind the distinction between phosphorescence and fluorescence. A phosphorescent substance is one which continues to glow in the dark after it has been stimulated by sunlight or electric light; a fluorescent material, such for example as resorcin blue, responds to stimulation only so long as it is within the influence of excitation, and becomes inactive as soon as the source of excitation is removed.

Mr. Hammer has found that by combining phosphorescent material with fluorescent liquids of various kinds, he can obtain a large variety of luminous paints. The fluorescent material can be dissolved in alcohol or ammonia and then thoroughly mixed in the phosphorescent material, so that each particle of the calcium sulphide is coated and impregnated with the fluorescent material. When the resultant mixture is stimulated by the mercury arc or other means, it glows with a most brilliant color, depending upon the fluorescent material used. Since many of the coal tar dyes have a marked fluorescent effect, it is possible to obtain a range of color which is indeed very wide.

The results are not always, and, in fact, not generally like the colors either of the fluorescent material or of the phosphorescent substance which is mixed with it, and which forms the main basis of the luminescent when excited Hence the art which Mr. Hammer has discovered, resembles in its practical application more the art of china painting, in which the artist uses colors of most incongruous appearance, which are entirely changed by the process of firing.

Of all the results which Mr. Hammer obtained, perhaps his white phosphorescent paint is most remarkable. Here we have a glow which is all but free from the usual greenish blue that is so characteristic of phosphorescence and that is usually so weirdly unpleasant. This phosphorescent paint is obtained by combining a mixture of phosphorescent zinc and calcium sulphides with alcohol, or with a trace of tincture of stramonium or uranin in alcohol and making a paint with oil

The possibilities of Mr Hammer's discovery are wider than may at first be imagined. Not only may aeroplanes and airships be painted entirely or striped in parts with luminous paint of various colors, but hangars, tents, and buildings may be coated in a distinctive way Moreover, the paint may be applied not only to the structures of an aerodrome, but to buildings along the route between two points Indeed, there would be no difficulty in mapping a very clear track for an aviator, between two cities—a track which it would not be hard to follow if the aviator is low enough



Photo. by Bonnar.

Lieut. Porte and Mr. Hallet in the "America's" bow.

Here the planing fins may be seen which were tested at an earlier period. Subsequently, side floats attached to the hull were used. These, while more successful, did not give the desired result

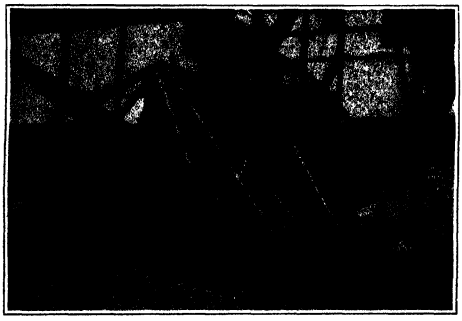


Photo. by F. Weyman

Sea-sled bottom under the "America," to make her skim the water with full load.

The lower front corners were curved upward to prevent scooping water when the boat dipped or met a billow The track supported the craft softly till she was launched in sufficient depth of water

The practical applications of the discovery are, of course, far wider The theatrical effects which can be obtained are at once obvious. The paint may be applied to draperies or to solid objects—indeed to any surface. Moreover, pictures may even be painted with these luminous paints—pictures which under excitation would possess an intensity most remarkable.

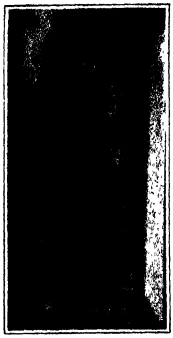
Did Prof. S. P. Langley Invent the First Practical Flying Machine?

By C. Dienstbach

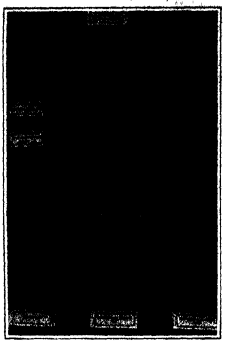
THERE seems to be good reason for determining the real merits of Prof. S P Langley's ill-fated man-carrying aeroplane of 1903 from the viewpoint of the most recent progress in flying machines, because the recent criticism by Mr. Griffith Brewer, in the face of the demonstration at Hammondsport, shows glaringly how the subconscious effect of ancient press derision is still liable to impair the memory of a great pioneer.

The only difficulty experienced at Hammondsport was in the machine's ability to lift the weight and overcome the air resistance of the pontoons and their framing, added for starting from the water The power of the motor constructed by Mr Manly has been established by tests of the same irreproachable scientific accuracy that distinguished the mechanical part of Langley's work from previous experiments with flying machines to be exactly 54 brake-horse-power—far in excess of the famous so-called 50 horse-power Gnôme motor, which still easily lifts two men Langley's propellers were tested equally well. As the total area of the wings was far more ample than in modern machines, a rather low carrying efficiency is obtained, which can be attributed only to Langley's plan of depending for longitudinal stability partly on wings in tandem. Of these wings, the rear pair are deliberately dis

(Concluded on page 65.)



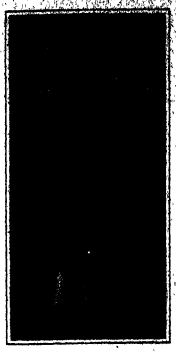
Modern Alpine popular costume.



Representation of the frequency of ascents of the Totenkirchl.



Alpine fauna group, including the chamois, ibex, and golden eagle.



Bridegroom's Alpine costume in olden times.

An Alpine Museum

By Dr. Alfred Gradenwitz

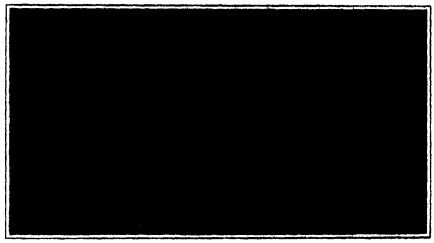
THE Alpine Museum founded at Munich by the German-Austrian Alpine Society, is intended to illustrate the relations of man to the mountain world at various times and in various forms, in the structure of mountains and glaciers, and in their flora and fauna. The technical and intellectual resources of mountain travel and mountain climbing are to be recorded and preserved for future times in their historical development, as far as the remains of the past will permit.

The museum is housed in one of the most beautiful parts of Munich on an island of the river Isar, close to Maximilianstrasse, and the new home of the German Museum, in an attractive rococo castle which, by its internal appointments, would not seem to be especially suitable for museum purposes. This drawback is, however, more than outweighed by the fact that the building is surrounded by an extensive garden which is not only adapted for mineralogical and botanical purposes, and for the installation of an open-air museum, but which affords ample space for an eventual extension of the museum and its central library.

On entering the garden, seventeen boulders of about 40 by 60 centimeters remind the visitor of the mountain world. It is intended gradually to represent by about 100 blocks of this kind all the more important rock formations of the Alps, with their characters and peculiarities, thus bringing them home to lay people much more forcibly than by the small samples generally contained in mineral collections. A special point is made of choosing specimens as characteristic as possible, which, at the same time, will even show other phenomena of geological interest such as decay, the effect of mountain pressure, fissure healing, petrifactions, etc. The samples so far installed illustrate the main types of rock of the schistose cover on the north side of the Central Alps, specimens of the most varied crystalline rocks which, though being in great part of a sedimentary origin, have been so transformed by subsequent processes (volcanic phenomena and those due to mountain pressure) that their geological age in the absence of petrifactions cannot be readily recognized.



Exhibit of Alpine snakes and butterflies.



One of the pictures decorating the walls. The crater of Cotopaxi, Ecuador.

On entering the vestibule, we are met by two life-size statues created by the sculptor, E. Geiger, a "Mountain Climber" and a "Navigator," which like friendly demons guard the entrance to the large hall. The vestibule is further decorated with four oil paintings of Alpine scenery.

The center of the large hall is occupied by a Jungfrau relief made by X. Imfeld of Zurich on a scale of 1 in 2,500, which, apart from the Glockner relief, is the only one of similar dimensions. The remarkable perfection of the relief from a technical point of view, the beauty and artistic effects of its renderings of mountains and glaciers, cannot be adequately depicted in words. An idea can, however, be formed of the laborious work of many years required to perfect this relief when considering that it comprises as many as 600,000 minute wire brushes plastered into the background, which imitate the woods and wonderfully enhance the plastic effects of the whole.

In the department of Alpine Mining, some instances are given of the useful minerals found in the Alps and exploited in mines. Showing as they do, side by side with ores, samples of mineral admixtures, these collections at the same time have a real scientific interest.

(*Concluded on page 68.*)



Relief model of the Jungfrau.



Boulders constituting part of the mineral collection.

Crossing "Greenland's Icy Mountains"

The Three Recent Expeditions Across the Great Ice-Cap

By Charles Fitzhugh Talman

Illustrated With Photographs Taken During the Danish Expedition Under Capt. Koch

THE real topography of the world's largest island is an eternal mystery. A narrow fringe of land along the coast lies bare in the brief summer, while on the slopes of the ice plateau, but not far inland, a few isolated peaks (*nunataks*) jut up through the ice and form little oases in the frozen desert, giving a foothold to a scanty flora and fauna. Aside from these insignificant patches of real *terra firma*, the whole vast land lies buried beneath a dreary waste of snow-covered ice, difficult of access on account of the deeply crevassed glaciers by which it is bordered, but not especially difficult to traverse, as Arctic wildernesses go, when once it has been fairly entered. Add to these features an intensity of cold rivaling that of the celebrated "cold pole" of northern Siberia; violent blizzards blowing down the slopes toward the coast; and in the interior, where the weather is normally calm, the rarefied atmosphere of great altitudes (ranging up to nearly 10,000 feet above sea-level) causing explorers to suffer all the distressing symptoms of mountain sickness. Such are "Greenland's icy mountains."

The first extensive journeys over the inland ice were made by Nordenskjöld and Jensen, in the '70's and '80's of the last century, and finally in 1888 Nansen accomplished the first complete crossing of the island from coast to coast. He traveled from east to west across the tapering southern end of the island, a distance of 350 miles, after a series of delays and mishaps had prevented him from taking a longer and more northerly route. In 1892 a far more difficult journey across the northernmost part of the ice was made by Peary. Again in 1895 Peary crossed, not far from his earlier route, and returned to his starting point on the northwest coast, a total sledge journey of 1,300 miles. The dangers and hardships with which this expedition was beset make it one of the most brilliant achievements in the whole history of Arctic travel.

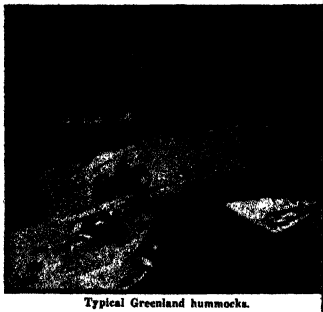
De Quervain's Expedition of 1912.

After a lapse of seventeen years the exploration of the Greenland ice was again undertaken, about the same time, by three expeditions. A Swiss party, under Dr. Alfred de Quervain, landed at Holstenborg, on the southwest coast, April 27th, 1912. The programme of this expedition was twofold, comprising important scientific investigations on the west coast, by Drs. Mercanton, Jost, and Stolberg, and the crossing of the ice-cap by Drs. de Quervain and Hoessli, and Messrs. Fick and Gaule. The western party made numerous measurements and observations of glaciers. Two of its members, Jost and Stolberg, spent the winter of 1912-13 at the Danish scientific station on Disko Island, where pilot-balloons were sent up at frequent intervals to determine the drift of the atmosphere at various levels, one of these balloons reached the remarkable altitude of 24.2 miles. Contrary to expectation, no definite circumpolar "whirl" was found by these observations. Dr. de Quervain's party started from the west coast June 10th, and gained the inland ice June 20th. With three sledges and thirty dogs the explorers took a straight course in a southeasterly direction. Early in the journey they had the misfortune to break through the thin ice coating of a large lake, but with no worse results than a cold bath. After a march of 435 miles they arrived safely at Augmagsalik, on the east coast, August 1st. The crest of the ice was reached two thirds of the way across, with an altitude of 8,200 feet, about 650 feet less than the altitude attained by Nansen in his crossing farther to the south. At each camping place on the journey the contours of the surrounding ice were measured in all directions with the theodolite, so that the total results constitute the survey of a zone a score of miles or more in diameter, extending across the ice-cap. Near the end of the journey a new mountain range was discovered north of the route, and quite near the east coast. The explorers named this region "Switzerland," and its highest peak (9,000 feet) Mount Forel. An entertaining popular account of this expedition has recently been published by the leader ("Quer durchs Grönlandeis," München, 1914) while the scientific results are to appear as a volume of the *Mémoires de la Société Helvétique des Sciences Naturelles*.

Early the same summer a Danish explorer, Capt. Koch, undertook the formidable task of crossing Greenland at its widest part. His companions were the well-known German meteorologist, Dr. Alfred Wegener, of the University of Marburg; a Danish sailor, Larsen; and an Icelandic peasant, Vigfus. After making a practice journey across difficult mountainous country in Iceland, the party proceeded to the northeast coast of Greenland, where they found the ice conditions so favorable that they were able to land without difficulty in the neighborhood of Cape Bismarck on July 24th. The plan of the expedition was to winter in Queen Louise Land, or at least somewhere on the border of the inland ice, which in this part of Greenland is at a considerable distance from the coast. In order to reach winter quarters with some twenty tons of stores and equipment, over a rocky country free from snow and ice, Iceland ponies had been chosen for transport in place of dogs. This choice seems to have been inevitable under the circumstances, though dogs would undoubtedly have been more serviceable in the subsequent journey across the ice-cap: Koch's experience confirming that of Scott and Shackleton as to the unsuitability of horses for polar travel.

Great difficulty was experienced in finding a practicable route to the summit of the ice over a rugged and much-crevassed glacier front. While the ascent was in progress the explorers had the rare, and in this case very dangerous, experience of witnessing the

Capt. J. P. Koch.
After a pencil drawing by Achton Friis



Typical Greenland hummocks.



How the horses were stabled in the ice.



Crevasse in the inland ice near the point at which ascent was made.



Horses used in preference to dogs for transportation.



Iceland horses on board; photographed from mast-head.

calving of a glacier at close range, and part of their stores were overwhelmed by the falling masses of ice. So much time was spent in scaling the glacier that the plan of wintering in Queen Louise Land had to be abandoned; a house was accordingly built on the glacier. This was named "Borg." Here the winter was spent in scientific work.

Adventures of Capt. Koch and His Party.

On the 20th of April the little party began the 700-mile march across the ice to the west coast. Day after day furious blizzards had to be faced. At times the march was suspended in the hope that the force of the wind would abate, but the explorers at length realized that violent winds blowing down the ice slope from the interior toward the coast were a normal and permanent feature of the climate; and this has been the experience of the other Greenland expeditions. These winds are analogous in character and origin to the outblowing blizzards of Antarctica, which proved fatal to Capt. Scott, and added so much to the hardships of Dr. Mawson's sojourn in Adélie Land. At the crest of the ice-cap Capt. Koch's party found light, variable winds, with frequent fog. In descending the west slope they had the wind at their backs, and, by fitting sails to their sledges, were able to make very rapid progress. The last nunatak on the east side of the ice was passed May 8th, from which time until July 2nd no land was seen. The ponies suffered with snow-blindness and exhaustion, and most of them had to be killed long before the end of the journey. The last of them was shot just before pasture land was reached on the west coast, after the explorers had actually drawn it on a sledge for several days, in the hope of saving this good comrade's life.

The greatest elevation of the ice, about 9,900 feet, was found nearer the west than the east coast, which was the reverse of de Quervain's experience. The explorers *suffered from sunburn by day and intense cold* by night (minimum 21 deg below zero, Fahr., in mid-summer)

On July 2nd the monotony of the journey over snow and ice was relieved by the sight of a nunatak, and 37 miles beyond this point the western edge of the ice was reached on July 4th. Shortly afterward the party succeeded in locating a small depot of provisions which had been laid for them two years previously. On reaching the ice-free littoral they had still to travel for 11 days, part of this time being spent in crossing the Lakse (Salmon) fiord and river in a boat improvised from their sledges and sleeping-bags. The little settlement of Prüven was reached July 15th, and the journey was over.

What the Koch Expedition Accomplished.

The scientific results of this expedition, a brief account of which has been published by Dr. Wegener in the *Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, and which are to be presented in full in the Danish publication *Meddelelser om Grönland*, are undoubtedly among the most interesting ever achieved in a polar expedition. Only a few details can be mentioned here.

At winter quarters measurements of the temperature in the interior of the glacier to a depth of 79 feet were made by means of a shaft and bore-hole beneath the dwelling-house. Below the level at which the seasonal fluctuation of temperature ceased, a slight but regular increase of temperature with depth was found, analogous to that which occurs in the earth. On the inland ice the stratification of the snow was observed, as seen in the walls of the pits dug at each camping-place as stables for the ponies. Each layer represents a year's snowfall, and thus an approximate idea was obtained of the precipitation of the region over which the explorers traveled. Dr Wegener secured a great number of microphotographs of snow and frost crystals, with simultaneous observations of temperature and humidity, serving to indicate the conditions under which the various forms occur. Numerous photographs were taken of mirage, also of the aurora borealis. Observation of sky-polarization made with the Savart polariscope

An even more remarkable journey across Greenland was made by two Danes, Knud Rasmussen and Peter Freuchen, with two Eskimos, who started from a point near Cape York, on the northwest coast, April 6th, 1912, and crossed to the northeast corner of the island, visiting *en route* the ice-free region of Peary Land. This was reported by Peary to be a separate island, and is still so shown on nearly all charts, but is now known to be merely the northernmost part of the mainland. After extensive explorations, in the course of which they discovered traces of old camps indicating that the Eskimos had preceded the white man to this remote region, the explorers retraced their steps, reaching Cape York September 15th. This journey was unique in that the party carried no regular provisions, but lived, *Eskimo-fashion*, on the country. Thus unencumbered, they were able to march 30 miles a day with ease.

One outstanding result of the recent campaign of explorations in Greenland is that former ideas regarding the general contour of the ice-cap have been considerably modified. Instead of being a more or less symmetrical dome, with the greatest elevation at the center, it is now known to have at least two principal summits; one a little north of latitude 65, the other at about latitude 74. A journey across the inland in a north-south direction—a more difficult undertaking than any of those described above—would doubtless



At the border of the inland ice.

throw much further light upon the true form of the great ice plateau under which Greenland lies forever buried from the eye of man.

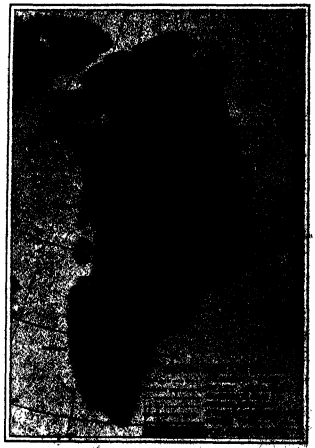
Teaching the Use of Current Periodicals in Elementary Schools

WILLIAM E. GRADY, principal of Public School 64, of the Borough of Manhattan, New York city,



"Borg," the winter house of the expedition.

has been trying to secure the co-operation of some of our best magazines and weeklies in inaugurating a new and a very necessary course in school curriculum. He feels that pupils are not trained to read intelligently various types of publications, such as newspapers and magazines, from which in later life they will have to glean the bulk of their knowledge. According to his plan, the different classes



Map of Greenland, showing routes of several expeditions.

will discuss current magazines under the supervision of a teacher, while discussion will take the place of the ordinary formal lesson dealing with the so-called "masterpieces of literature." Mr. Grady's scheme is outlined in the following plan of work:

Point of View:

"A thoughtful criticism of our current literary teaching in the upper grades of our elementary schools is to the effect that pupils are not trained to read intelligently various types of publications, such as newspapers and magazines, from which in later life they will have to glean a great part of their knowledge."

I. Material shall be stamped with school stamp and shall be filed and catalogued in a special room.

II. On request countersigned by principal or assistant, teachers of 6A, 6B, 7A, 7B, 8A, 8B group may borrow such material for purpose of actual instruction in their several subjects. Such material shall be returned to its room on same day.

III. Teachers using such material are requested to form judgments as to its value and to discuss results with the principal.

IV. General topics and controlling ideas suggested for consideration in connection with said material are the following:

(1) Pupils should be led to appreciate that the reading of such material is a real test of mental ability in general and of reading ability in particular; that many of the facts in after life, whether such facts be cultural or technical, must be gleaned from such sources.

(2) Teacher's instruction shall subordinate mere facts to methods of sound thinking. To the extent that pupils display individual taste and judgment in the selection of articles for discussion, to the extent that they distinguish the relative importance not only of articles, but also of paragraphs and statements within the limits of said article, and to the extent that they can epitomize an article in a series of concise, well-knit sentences, the work will be distinctly educational, rather than the mere employment of a leisure moment.

(3) The organization of the magazine or periodical should be discussed in terms of the following:

(*a*) Title, company, cost.

(*b*) Aim and value in terms of range of topics, reputation of contributors, point of view of editorial articles, relationship of articles in monthly or weekly publications to the current events of each month as reported in the daily papers. For example, note the different aims of such magazines as *Collier's, Literary Digest*, SCIENTIFIC AMERICAN, *The Survey, St. Nicholas, Good Housekeeping, Ladies' Home Journal, Review of Reviews, Outing, The Outlook, The World's Work, Scribner's*, etc.

(*c*) Illustrations and cartoons.

(*d*) Quality and range of advertisements.

(4) Test value of work with pupils in terms of particular lesson units and also more generally in terms of:

(*a*) Reading habit as indicated by knowledge of current events.

(*b*) Desire to include good current topics as basis of oral or written composition.

(*c*) Critical judgments as to what magazines, weeklies, etc., and article therein, interest them most.

(*d*) Increased appreciation of design, drawing, and lettering.

(*e*) Occasional purchase of or subscription for material used in classroom discussions.

(*f*) Increased use of facilities offered by reading rooms in Tompkins Square Library, Christadora House, Cooper Union, etc.

(*g*) Organization of pupil groups on club plan to purchase publications to be circulated within the limits of the group.

V. If the literary material obtained through the courtesy of the various publishers be used by the departmental teachers of literature in every 3-minute or 4-minute lesson to supplement the study of the masterpiece designated in the course of study, the work will be distinctly more practical and cultural.

Moreover, the teachers of special subjects like geography ought to find it possible really to vitalize the subject matter of the text-books by the study of current happenings. The destructive action of spring floods in the Mississippi Valley or the heroic death of Scott in the white wastes of the Antarctic should provide the initial rather than the final steps of instruction in geography and history.

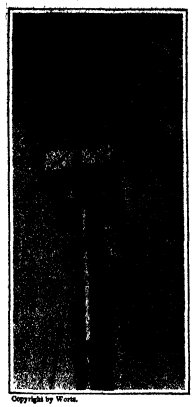
Cleaning Plaster Statuettes

A SIMPLE but effective method for removing the grime which plaster statues, etc., gather in the atmosphere of cities is suggested by *Les Annales*. A thick solution of starch, such as laundresses use, is made and the object is covered with it, care being taken to have it penetrate every crevice. The starch paste is then allowed to dry, whereupon it, of course, carries with it the dirt on the surface of the plaster.

A Simple Method of Erecting Tall Wireless Masts

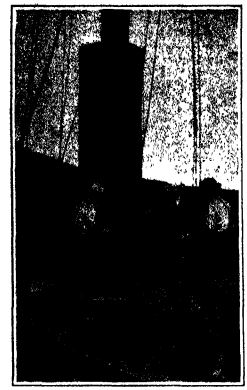
In the construction of the chain of world-encircling wireless stations which are being erected by the Marconi Company, the importance of a thoroughly reliable yet simple aerial support was one of the first considerations. These photographs, made at the station at Hawaii, give a very good idea of how these masts are constructed.

A concrete base was first laid and a bed plate fastened to it. The mast came in split cylindrical sections about ten feet in length. The flat sections of these semi-cylinders were placed face to face, bolted to the bed plate, and the faces bolted together. Then a man cage was constructed and rigged to a system of blocks and tackles, so that it could be raised as the mast grew. The sections were "staggered," that is, one would be placed at right angles to the one preceding. Guys were attached as the work progressed. Towers as high as 450 feet were erected in the course of a few days.



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Erecting a 450-foot mast.



First mast-section being set in place.

Treading on Time

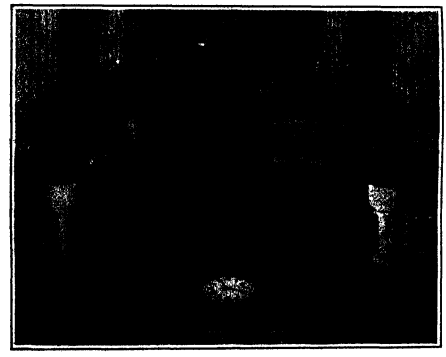
VISITORS at a recently completed hotel in Worcester, Mass., are able literally to "tread time under foot."

In these days we are becoming accustomed to seeing electricity doing almost anything, from turning the turrets of a battleship to drying Milady's hair; but deliberately to walk across the face of a perfectly good clock set in the floor is a decided novelty.

The dial is of plate glass, 2 feet in diameter and 1 inch thick, the numerals and minute marks being etched on the under side. Under each hour sign is a tungsten lamp, the entire mechanism and lamps being contained in a metal box 10½ inches deep, painted white on the inside, so that the illumination is brilliantly striking, and the shadows cast by the hands exceedingly dark.

The clockwork is driven by a spring, wound every five minutes by an electric motor obtaining its current from a battery of three "dry cells," and the time is regulated automatically every hour by telegraphic connection.

In some ways it seems more convenient to "get the time" by looking down rather than up, as most of us are accustomed to do, the only drawback apparently being that it is necessary to stand in the right position with reference to the clock face, or else acquire the facility of reading the time "upside down," which to most people would be somewhat awkward at first, although the knack soon would be acquired.



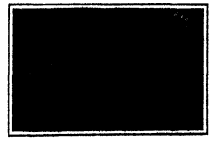
Electric clock set in the floor of a hotel lobby.

Professional Snake Catchers

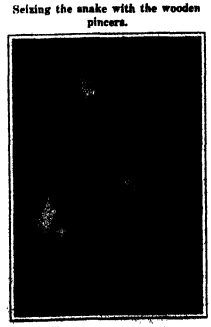
THE German government regularly employs men attached to the forestry service to exterminate poisonous snakes. The snakes are not found in great numbers, but are sufficiently numerous in mountainous and wooded districts to constitute a menace to women and children picking berries or collecting wood, because these people generally go barefooted. The snake-catcher wears thick cowhide boots through which the snake is unable to push its fangs.

In catching snakes the man uses a pair of hinged sticks, like pincers, which he presses against the snake's neck immediately behind the head, thus making it powerless to move its head. Some care must be taken, because the snake will sometimes eject its poison, and if this should enter a scratch or cut, it would cause the same effect as if the catcher had been bitten. While the snake is in this position, the catcher grasps its tail and throws it into a strong leathern bag with a swing, releasing the neck. The bag is securely tied and the snakes carried home, there to be disposed of.

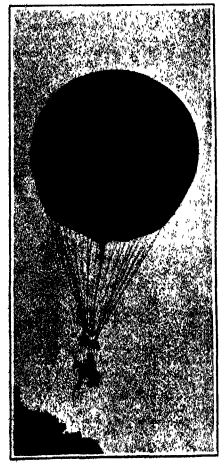
The poisonous snakes of Germany are mostly adders, and the one most frequently met is the *Pelias Berus*, or Cross Adder, so called because the back is marked with a cross-like pattern.



Seizing the snake with the wooden pincers.



A professional snake catcher.



A thrilling "movie" adventure.

Twenty-four Hours in the Air

THOSE in charge of the Wanamaker transatlantic expedition must surely find encouragement in the remarkable performance of Reinhold Boehm, the German aviator who at Johannisthal on July 11th achieved the feat of flying continuously for 24 hours and 12 minutes.

His was an ordinary army Albatross biplane, fitted with six-cylinder 75 horsepower Mercedes engines, and carrying 132 gallons of gasoline. It was the same machine in which Landman's record of 21 hours and 40 minutes in the air was made on June 28th. His provisions consisted of a vacuum bottle filled with cold milk, several packets of chocolate, and a few cakes.

He ascended easily, and in order to save fuel flew slowly around the aerodrome at first, not going higher than 300 feet. As the night wore on and the signals flamed out he went higher, and for an hour or two he left Johannisthal, flying across Berlin and Potsdam.

Returning to the aerodrome at midnight, he resumed his weary circuit. How many rounds he made nobody knows.

Boehm must have covered about 1,350 miles, as his speed averaged 47¼ miles an hour throughout.

Relative Motion and the Automobile

AT a recent meeting of the session of the British Institution of Automobile Engineers Dr A M Low gave a very interesting lecture on "Some Experiments and their Bearing on the Design of Automobile Parts."

The line taken by the author was to advocate the study of the motion of the different parts of the car from the point of view of the actual parts themselves. Dr. Low instanced the carburetor, which is adjusted with extreme care as to the weight of the float, etc., and is then fitted on an engine which is vibrating in such a way as to upset the accurate adjustments made. He stated that he had fitted an instrument, which he terms the "Chattergraph," for observing the action of the brake-shoe on the drum; the instrument showed clearly that the motion of the shoe in relation to the drum is a constant series of rotations of the whole drum with the shoe, alternating with a movement of the shoe in the drum. He pointed out that there are three methods of studying motion—the rotating mirror, the alternating generator with variable period, and kinematograph. He strongly advocated the use of the kinematograph by automobile designers for the study of the motion of the various parts of a car, and exhibited some experiments indicating the results which could be obtained. One of these experiments showed the action of a valve lifted by a cam, and the lecturer pointed out the bouncing of the valve off its seat with improperly shaped cams. He also gave the results of experiments on an induction pipe fitted with a glass window with two eye-pieces and a shutter revolved by means of a cam from the engines; by this means the actual form of the globules of oil mixed with the gasoline could be traced in various positions in the pipe.

An Aerial Ride on Horseback

A GERMAN moving-picture manufacturer has turned out a film that shows a novel and very sensational feature. A bandit chased by soldiers is nearly caught when he catches sight of a balloon very opportunely tied to a post and awaiting his pleasure. He ties his horse to the balloon and unties the mooring rope. Immediately he is carried into the air, and the soldiers cannot get him. The film shows the balloon, with horse and rider fastened to it, sailing through the air, until it finally collapses and drops into a sheet of water, whereupon the bandit loosens the ropes and escapes. The remarkable feature is that this exploit was actually executed, and a live horse and rider were tied to the balloon, as is shown in the accompanying photograph.

The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

Novel Truck for Aeroplane Transport

By Our Berlin Correspondent

A NEW type of aeroplane transport has been designed by a German engineer, which dispenses with any special tractor. Hence it may travel backward and in loops, which is a most important feature from a military point of view. Moreover, the aeroplane is supported at its most delicate points, thus avoiding any distortion or injury.

While special repair cars accompanying the aeroplanes have been used with success at the French army maneuvers, this truck has itself been designed as a traveling repair shop, carrying all exchange parts and tools. The speed of traveling can be increased up to 40 miles and more per hour, which is a decided advantage over ordinary transport vehicles traveling at 12 miles, as, in the event of breakdown to the aeroplane, assistance can be thus obtained much more speedily.

The body of the vehicle is fixed to the two axles and strapped to a tipping device. The supporting planes of the aeroplane are strapped to two upholstered guides. Seating accommodation for four men and room for a bed is provided. A tarpaulin carried on the truck dispenses with necessity of an aeroplane tent. The aeroplane is loaded on the vehicle and covered with the tarpaulin, as the night comes on, so as to be always ready to start operations. The same tarpaulin, of course, serves to protect the aeroplane, while under way, against injury by branches, etc.

Lessons from the Railroads for the Truck Owner

By H. S. Whiting

TO those who have observed the numerous lines of interurban express and delivery companies that make use of the motor truck for the transportation of freight and merchandise between cities many miles distant, it might be assumed that the commercial vehicle is becoming a serious competitor of the railroad for short hauls. Possibly for the purely local traffic, the motor truck has, in a measure, supplanted the freight car, but that at no gross loss in the business of the railroads. In fact, rather than proving a competitor of the railroads, the motor truck now assumes the guise of their ally, and through improving the shipping facilities of points distant from the railroads, new territories have been opened that had never been extensively "tapped" by the railroads. Every passable highway is now a feeder for the railway toward which it leads, and where horses formerly hauled their hundredweight, motor trucks now carry their tons.

But the motor truck owner must learn his lesson of efficiency from the railroad if he would obtain the most from his installation. Through a wonderful system of grouping and arrangement of different cars with various consignments, freight is now handled with a minimum of loss in time and labor, from the moment the goods are delivered at the station until they reach the freight yard of their destination. But this efficiency does not begin until they are delivered to the railroad company, and it ceases as soon as the goods pass out of their jurisdiction, for trucking systems at the freight terminals are notoriously inadequate. In fact, so inefficient have been the systems whereby freight was delivered to the shipping platform and hauled away, that in some instances the railroad companies have endeavored to install systems of their own.

The ideal motor truck system would be one in which the vehicle could be sent with a normal load on both the outward bound and the return trip, and would be forced to make only a minimum number of stops during its journey. The railroad companies long ago taught us that it cost nearly as much to haul an empty car as it did one that was loaded; and while the wear on tires and the gasoline consumption of a truck running "light" may not be quite as great as is the case when it is filled to normal capacity, nevertheless, the former is naturally a non-productive trip, while the latter is the work for which the truck was designed and for which it is expected to show a profit. But in spite of this basic principle of transportation theory, we constantly find three and five-ton trucks proceeding to the freight terminal with 100 and 200-pound loads, and then the truck owners complain that the vehicle does not show a profit. The department stores learned long ago that a light, high-speed delivery wagon for small parcels and a heavy truck for bulky goods formed a combination far more profitable than the use of a single vehicle for both purposes. But the department store delivery truck cannot, as a rule, travel loaded in both directions, and the return trip must be made practically empty. If the freight truck could run to the terminal with a full load, and exchange this for another to be delivered throughout the city, it could be made to show a handsome profit throughout every foot of its progress. But to do this, we must presuppose a system of interchange of orders and the distribution of the goods to be picked up and delivered by localities so that the various trucks could be loaded in the shortest possible time. This would necessitate a compact organization, and as most of the trucking to and from our large terminals is done by small, independent companies or individuals, the day of the efficient handling of freight is still in the distant future.

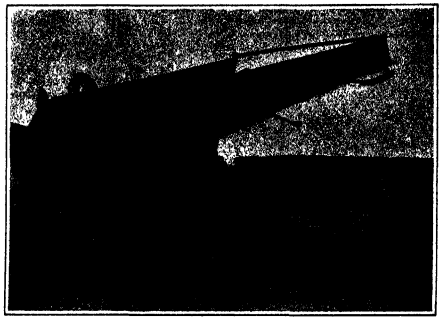
Next to the small loads that are carried by many of the vehicles doing a terminal trucking business, the time lost at the loading and unloading platforms proves the greatest source of lost efficiency. Driver's wages, insurance, depreciation, and interest on the investment continue, whether the truck be idle or in motion, and the loss of a few minutes time at each platform on each trip may make all of the difference between a profitable and an unprofitable installation. To overcome this difficulty, removable cages or inclosed, detachable bodies have been devised which may be quickly secured to the platform of the truck. This enables one body to be loaded while the contents of another are being delivered, and by this means the truck is kept in operation throughout the greater part of the day. But such a system is only applicable to a trucking or delivery business that collects the goods at one platform, and an installation in which the trucks obtain their loads by the "pick-up" method at various points cannot employ these labor and time-saving, removable bodies.

But in spite of modern equipment, trucks that deliver goods to congested freight terminals in the railroad yards or at the wharves cannot realize fully on the investment represented if time must be lost while "waiting in line." Loading and unloading platforms must be large enough to accommodate the traffic, and if arrangements could be perfected whereby deliveries and collections at the terminals could be more evenly distributed throughout the day—and night, if necessary—far more efficient service could be obtained. Of course, the short time allotted to the loading and unloading of a transatlantic liner makes congestion at the piers inevitable, but with the daily and hourly departure of freight trains, it would seem that various consignments could be sent through on schedule in much the same manner as the trains themselves arrive at and depart on a certain prearranged time. A motor truck is not only a road locomotive, but a train of several load-carrying cars, as well, and when it is delayed, the proportionate loss encountered is equal to that entailed by the tie-up of an entire freight train.

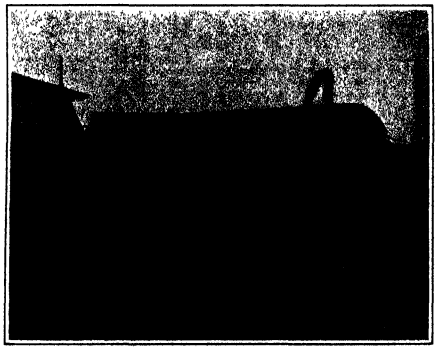
But let it not be inferred that traveling at full load with a minimum amount of delay is the only requisite for a successful truck installation; to be "busy" is not the only mission of a truck; the routing of an ordinary delivery system is as important as are adequate loading facilities and the elimination of delays *en route*. This point is well illustrated by the experience of a large department store in a certain metropolis of the Middle West. The store in question installed thirty trucks of a well-known make on the representations of the dealer, who was sincerely certain that the new delivery system would show a marked saving in expense over the old horse system. The management of the trucks was delegated to the delivery superintendent, who had been with the firm for years, and who was familiar with every inch of the territory covered. The machines were to be cared for in the garage of the agent, who was to inspect them daily, make all necessary repairs and adjustments, and furnish all gasoline and oil for a stated sum per month. The driver of each truck was to do no more than operate the vehicle and deliver the goods, and any roadside adjustments to be made or troubles to be remedied were to be undertaken only by the experts furnished by the agent. It seemed as though conditions were well-nigh ideal for the success of the first all-motor delivery system in the city in question.

But there was a leak somewhere; the thirty one-ton trucks did not seem able to perform the work of an equal number of one-horse delivery wagons. The trucks would leave the shipping platforms well-loaded each day, and their odometers indicated a mileage even greater than was to have been expected. But the agent, sure of the ability of his trucks, went deeper than mere weights of loads and daily distances covered, and his investigations soon brought to light the real reason for the seeming failure of the truck delivery system.

The entire difficulty lay in the routing of the vehicles; several trucks would cover the same territory, and the same streets would be traversed two or three times by the same machine; small packages that should have been delivered by a boy were sent in trucks to houses only two or three blocks distant; two or three of the trucks would be loaded with pack-



Aeroplane transport, showing the upholstered wing-support.



One of the wings removed to show the repair shop.

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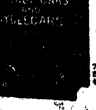
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ages for both the southern and northern portions of the city. In other words, the trucks were loaded with consignments with no regard to their distribution by localities. Further investigation disclosed the fact that the delivery superintendent, in whom implicit confidence had been placed, had intentionally so arranged the routing of these trucks that they would not compare favorably in cost with the old horse system of delivery; and it was proved that his interest in the horse system had been based on a certain commission that he had been receiving from the company from which the store had previously purchased its horses. The dismissal of the delivery superintendent and a proper rearrangement of the routing resulted in a marked change in delivery expenses, and the trucks from that time on have shown a most satisfactory saving over the former horse system.

Motor Truck Notes and Queries

L. P. C. writes. "Have any of the States enacted laws indicating the width of tires that should be used with loads of given weights? Of course, a narrow tire will cut a road more than will one of a greater width used with the same load, for in the former case, the weight is concentrated on a smaller area of tire contact. However, I do not know whether any of the States have taken cognizance of this fact."

A. Some of the States have passed laws indicating the tire widths that should be used with loads of various weights. Others have only specified the amount of the load that is allowable per inch of width of tire. In such instances, the meaning is not exactly clear, for it is obvious that the width of contact (which is really the determining factor in road wear) is not necessarily constant with different kinds of tires of the same width. For example, a flat, steel tire will have its full width in contact with the road, and will not cut the surface as badly as will a rounded rubber tire of the same width at its base and carrying the same load. Because of the circular cross-section of the pneumatic tire, the length of its "line of contact" with the road surface is least of all; but as only comparatively light loads are carried on pneumatic tires, this phase of the question is not as serious as might be the case otherwise.

N. K. D. writes: "I employ a 5-ton truck that is used only on hard, level roads. The power of the motor seems ample to haul double this load under these favorable conditions, but of course this would soon ruin my tires. I do not like to use the surplus power of my motor for obtaining excessive speed, and would therefore welcome a suggestion from you as to the best way to get the most out of my truck."

A. The conditions of operation of your truck seem to make it unusually well suited to the use of a trailer or a series of trailers. You have exactly the right ideas as to the harmfulness of overloading and excessive speeds, and we believe that the use of a trailer will enable you to retain all of the advantages of both without their disastrous consequences. As you may know, trailers are trucks especially constructed to be attached to a motor vehicle, and thus to enable the former to haul double its normal load without extra strain on tires or running gear. If several are to be drawn, the rear axle, as well as the front, of each is designed to swivel so that each will follow in the track of its predecessor, and sharp turns may be negotiated as readily as though only the one truck, or tractor, were involved. Some special types of trailers are designed with a spring tongue or coupler, that enables the load of a series to be taken up gradually, so that the truck can be started easily without undue strain. The effect of these springs is similar to the result obtained when a heavy freight train first moves backward a slight distance in order that there will be "slack" throughout the train, so that the engine may take its load gradually as it assumes headway.

Did Prof. S. P. Langley Invent the First Practical Flying Machine?

(Concluded from page 59.)

posed in the wake of those in front, but recent developments show often a studied sacrifice of efficiency in the interest of safety. In comparing Langley's work with that of the Wrights and their French imitators, the fundamental difference must be kept in mind, that Langley somehow *considered himself scientifically bound to solve the problem of inherent stability.*

That was why in his eyes it seemed of paramount importance to experiment with very large, unmanned models. Will his merits be at last appreciated, if we see the aeronautic scientists of this day, especially the English and German students, bend all their energy, as he did his, to this same problem of inherent stability, and if we see Orville Wright himself, in pursuit of the identical aim in his newest flying-boat, going so far as to adopt the old Maxim-Langley principle of a dihedral angle? The success of the large Langley models is undoubted. But we are apt to overlook the most perfect of them, which had an explosion motor, and which really surpassed the sensational steam model which flew in a calm in 1896. We are also apt to overlook the long series of flights made both by the second and the first steam models under varying conditions, some in considerable wind. These flights were undertaken to furnish a basis for designing the improved explosion motor model and man-carrying machine, which was only four times larger.

To Langley belongs the merit of having anticipated, by the general trend of his mind and his intense sense of scientific responsibility, the most important achievement of to-day—knowledge of the effect of proportioning the different parts of an aeroplane to secure stability.

This science has been systematized wonderfully in England. Langley, realizing its full importance more than a decade ago, thought it a most complex art to which, "for lack of a better term, he wished to apply the name of *aerodromics.*"

The longitudinal stability of the Langley machine is irreproachable, because in the man-carrying machine he employed, in addition to the features which made its exact counterparts, the models, so automatically stable, the same means—a rear elevator—that controls the Wright machine. It had, in addition, inherent stability from properly proportioned following surfaces, and automatic stability by employing its rear elevator as an elastically connected Pénaud tail, a device according to Chanute's testimony, invented (and communicated to Langley), but unfortunately abandoned, by A. M. Herring. The "Pénaud tail" is, moreover, only a different name for what the French now call a "V" between planes and tail. Tandem surfaces as used by Langley do waste power, and in view of the recent Hammondsport difficulties it may be of interest that Prof. Langley's engineer, Charles M. Manly, told the writer in 1905 that if he were to continue the experiments he would put wheels under the machine and fly it over land.

The question remains: can the machine fly without the Wright control to help? To this there is the answer that a prominent school of aviators, whose most notable exponent is Helmuth Hirth, the German champion, prefers the use of the rear rudder alone and reliance on a zig-zag course to wing warping, and a straight course for lateral stabilizing in gusts. Since the Langley machine has an efficient rear rudder it ought to fly if not loaded too heavily.

Further, as was to be expected from the strictly *practical* nature of the experiments with the big Langley models, the dihedral angle is so proportioned that, as in the newest Wright aeroboat, it is a valuable help and not a hindrance to lateral stability.

The most elucidating criterion is furnished by a comparison with the German "Fokker" machine, in which the dihedral angle has been so skillfully used that, in spite of the absence of any wing warping devices or ailerons, it meets successfully

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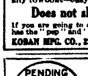


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the exacting demands of German military service. This has been accomplished by simply placing the center of gravity high enough. A side gust encountering nearly as much "dihedral surface" below as above it, thus balances itself as to the upsetting effect. A side view of the Langley machine shows, likewise, considerable wing surface below the center of gravity. What is still lacking, in comparison with the "Fokker," is supplied by the identical effect of the "keel surface" of the body of the long "boat," inclosing the boiler in the steam models, and the position of the vertical rudder in the gasoline machines. Then, too, why have the long, light cylinders for floating the models on the water been placed below and not above the center of gravity?

Watercycle Races at Enghien-les-Bains

(*Concluded from page 56.*)

part, at 2:45, first heat of the first class, at 3, first heat of the second class, at 3:15, heat of the third class; at 3:30, heat of the fourth class, at 3:45, final heat of the first class; at 4, final heat of the second class, at 4:15, parade of the miscellaneous machines past the judges, at 4:30, race of the fifth class, at 4:45, race of the sixth class; at 5, race of the seventh class; at 5:15, Omnium race, obligatory on all contestants.

Each race for the classes was over a distance of 900 meters, or three times round the course; the closing, Omnium race, was over a distance of 2,400 meters, or eight times around the course. The prizes for the races by classes were medals of silver-gilt, silver, and bronze, for the final, Omnium race, the prizes were in money, ranging from 200 francs as first prize to 25 francs.

The machine which proved the most successful was the one constructed by M. Louis and piloted by himself. It won the race for the first class over five other competitors in 5 minutes 49 seconds, and the Omnium race in 35 minutes 31 2/5 seconds. The picture given of it shows the simplicity of its build. There are also pictures of two other contestants of the first class, the Duthell machine which came in third, and the Duguet machine which came in fifth. The race for the second class was won by the Bernhardt machine piloted by Begnez, in 5 minutes 53 seconds, the same machine, with the same pilot, was second in the Omnium race, being ten meters in this behind Louis. The Bernhardt machine had already been the winner in another meet held elsewhere before this. The third class race was won by Lagrand's propeller "Kano" in 6 minutes 7 seconds; this machine, which was mounted in a very light canoe hull, and piloted by its owner, was third in the Omnium race. The only fourth class entry could not appear on account of an accident. In the race for the fifth class, the machine "Schweitzer IV," piloted by Camus, had the course to itself, as its rival met with an accident in the garage. The only entry in the sixth class, the machine "Schweitzer V," piloted by the younger Schweitzer, had naturally a walkover. In the race for the seventh class, the machine "Cailliez," piloted by Cailliez, won in 7 minutes 50 seconds; the same machine was fifth in the Omnium race. We give a picture of this machine. The Schweitzer machines, of which we give two cuts, one showing an aerial propeller, are called "hydrocars," and lay more claim to comfort and security than to speed. Among interesting entries of machines which were not winners was Rénégent's machine, called the "Autobus"; this machine can carry six people, and received a medal from the jury.

In discussing the impressions of the race in its issue of the next day, *L'Auto* emphasizes the simplicity of structure of the Louis machine and the ease with which it can be managed, as making it a good type of a quick, light, and well-balanced water-cycle. It then says, in brief, that the two points in which the builders of water-cycles evidently need to seek improvement are the floats and the propellers. All the contestants whose machines were mounted on floats had difficulties on this account, except the winner Louis, whose floats had the least contact with the water, and came the nearest in excellence to the floats of a hydroaeroplane. The pilot did not have to work hard in pedaling this machine, while its speediest rival, the Bernhardt machine of the second class, was driven along the water with considerable effort. As regards propellers, the question of aerial propellers versus water propellers is still an open one. The wind that blew at the time of the race was a deterrent to the machines with aerial propellers, so that as far as this race is concerned, the propellers under water can claim the victory.

An Alpine Museum

(*Concluded from page 60*)

The most important trees of the tree limit, viz., pine, fir, larch, sycamore, maple, etc., are exhibited in photographic reproductions from Fischbach's original drawings. Dried samples and preparations kept in formaline water show in a natural state the most important parts of these trees and of the mountain juniper. A special diagram informs the visitor of the season of snow melting and snow-falls at various altitudes. A schematic, ideal landscape illustrates the various regions of vegetation in a given part of the Alps, from the valley to the snow-clad peaks, the altitudes above sea-level being marked by lines. Special attention is given to such beautiful Alpine flowers as edelweiss, gentian, etc., which are threatened with extinction and for the protection of which energetic measures are being taken.

The longitudinal wall of the hall is taken up by four cabinets devoted partly to ethnography and partly to the history of Alpinism and the development of mountaineering. Many specimens relating to the customs of the inhabitants of Alpine countries, such as richly decorated spinning wheels, doll cradles, embroidered belts, knives and forks of embossed silver, inlaid spoons, pocket altars, watches with compass, etc., form the beginning of an ethnographical collection. Popular costumes are likewise represented by a number of models and painted wooden figures.

Panoramas and maps could unfortunately be given only a rather limited space. An earth profile of the zone intermediary between 31 and 65 degrees northern latitude at the scale of 1 in 1,000,000 gives a strikingly distinct idea of the ratio between the size of the earth and the elevations and depressions of its surface. In order to give an instance of its wonderful instructiveness, it may be said that this profile readily shows why the lightning flashes of a thunderstorm in the Iraun Valley, in spite of an intervening distance of 166 kilometers can still be observed in Munich as reflected sheet lightning. Some optical instruments, ancient and modern, for the use of mountaineers are contained in a glass case on the southern side.

In the northern colonnade, we are struck by the comprehensive view of first ascents in the Eastern Alps. An attempt has been made here to give a chronological picture of the opening up of this part of the Alps, as far as the first ascents can now be ascertained. We thus see that all the more important peaks had already been ascended before the forties of last century, when a powerful development commenced, leading to the systematic opening up of the mountains.

The hygiene of mountaineering is illustrated in many ways. Numerous diagrams and curves impart useful information on the number of blood corpuscles corresponding to various altitudes and to rapid changes in altitude, the causes and symptoms of mountain sickness, the average consumption of breathing air in overcoming a given level difference at different altitudes, the consumption of energy in ascending and descending, as well as on the level and differences in the efficiency of the organism with and without a moderate consumption of alcohol. The importance and growth of Alpinism is strikingly shown by a collection of present-day periodical Alpine literature, which even includes South Africa and Japan.

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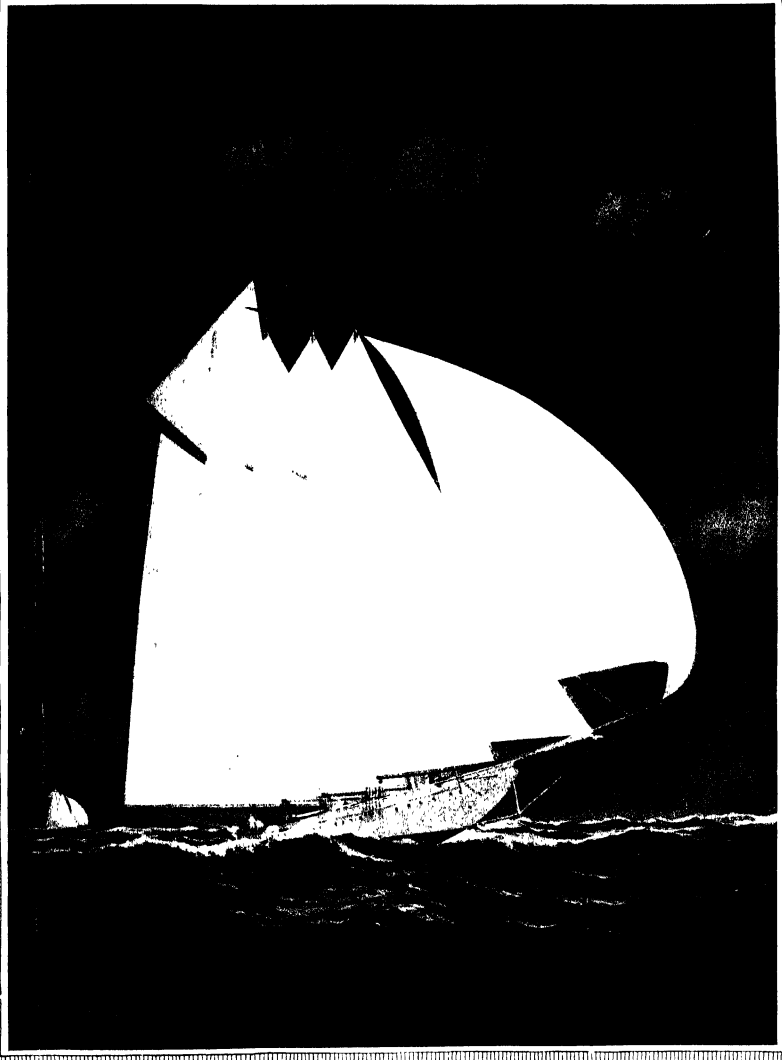
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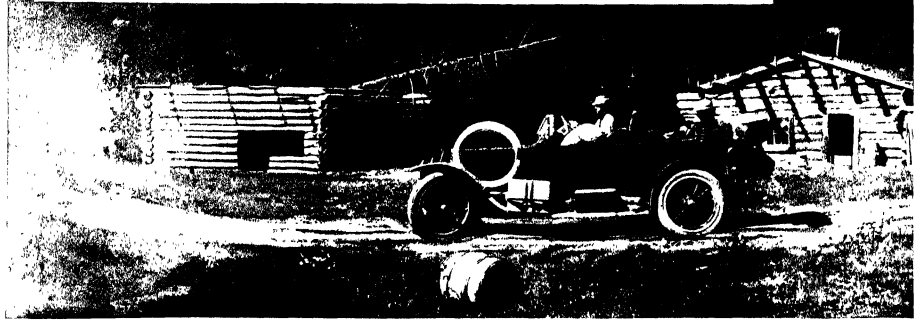
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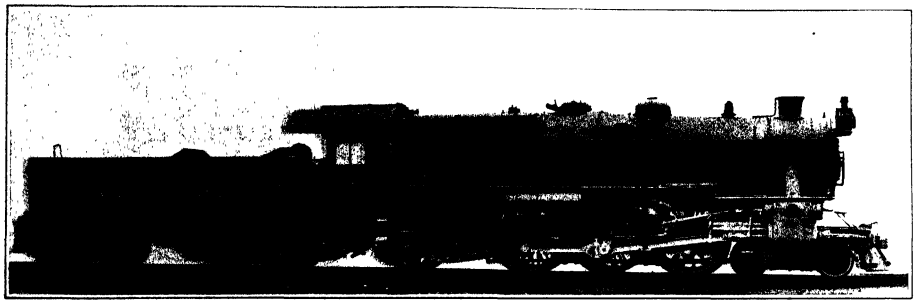
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Two-cylinders (simple) 27-inch diameter by 28-inch stroke. Steam pressure, 205 pounds. Heating surface, 5,766 square feet. Diameter driving wheels, 80 inches.

New Pacific type superheater, passenger locomotive for the Pennsylvania Railroad.

Recent American and European Express Locomotives

THE two powerful locomotives herewith illustrated represent two of the most recent designs in this country and abroad, of express passenger locomotives. One was built by the Pennsylvania Railroad for its heavy service between Altoona and Pittsburgh, the other is of German make, for the Roumanian State Railways.

During the last few years the Pennsylvania Railroad Company has felt the need of a larger freight locomotive for use on the main line, between Altoona and Pittsburgh, in order to reduce double-heading to a minimum, and to avoid breaking up trains arriving at Altoona and Pittsburgh before sending them forward over the Pittsburgh division. It was also thought desirable to experiment with a very heavy Pacific type locomotive for passenger service on this same division. With this object in view a Mikado locomotive which bears Pennsylvania Railroad classification "K-4-s," have been developed. The first "L 1-s" locomotive was placed in service about the 1st of May of this year, while the first "K-4-s" locomotive was placed in service last June.

Inasmuch as the road clearance is somewhat limited, also the weight per pair of driving wheels is limited to 65,000 pounds with a 5 per cent margin for scale variations, and the dynamic augment of the unbalanced reciprocating parts at 70 miles per hour is limited to 30 per cent of the weight on the drivers, it was necessary to keep the locomotives within restricted limits and make the revolving and reciprocating parts as light as possible, and at the same time maintain the necessary strength. Further, it was found desirable to maintain as many parts as possible interchangeable in these two types of locomotives, and to use as many parts as possible which are embodied in the design of the "E-6-s" locomotives.

The locomotives are equipped with all-steel cabs which are considerably smaller than the standard type of cab used on the Pennsylvania Railroad. On account of the fact that the locomotives are equipped with screw reverse gear a cab of great length is not necessary, and it is believed that the shorter cab will give the engine crews better opportunity to observe signals.

The running gear has been lightened as much as possible by the use of heat-treated material for driving axles, crank pins, piston rods and side and main rods. The axles, crank-pins, wrist pins, and piston rods are provided with holes through them with a view of reducing the weight and at the same time providing a better chance for the heat-treatment to take effect.

The trailer truck is what is known as the "K-w" truck, this truck being interchangeable on the "E-6-s," "L-1-s," and "K-4-s" locomotives.

The driver brake arrangement is particularly interesting on account of the arrangement of cylinders, this arrangement being necessary to provide sufficient space for two 16-inch cylinders which are necessary for proper control.

The locomotives are equipped with Schmidt smoke tube superheaters and security fire brick arch.

Subjoined are the leading particulars of the Pacific type, "K-4-s" express locomotive as herewith illustrated:

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Estimated Total Weight in Working Order, Pounds	305 000
Estimated Total Weight on Drivers, Pounds	200 000
Kind of Cylinders	Simple
Diameter and Stroke of Cylinders	27 & 28 Inches
Kind and Size of Valves	14-Inch Piston
Driving Wheels, Diameter over Tires	80 Inches
Type of Boiler	Belpaire
Working Pressure, Pounds	205
Outside Diameter of First Course in Barrel	78½ Inches
Fire Box, Width and Length	80 x 126 Inches
Tubes, Number and Outside Diameter	247—2¼ Inches
Tubes, Length	226 Inches
Heating Surface, Total Square Feet	4 045 4
Superheater Heating Surface, Square Feet	1 154 9
Grate Area, Square Feet	70 0
Center of Boiler above Rail	10 feet 1 inch
Equivalent Heating Surface	5 700 sq. feet

Our other illustration shows the first of a series of Pacific type express locomotives which have recently

(Concluded on page 88.)



Four cylinders (simple), 16½-inch diameter by 25½-inch stroke. Steam pressure, 185 pounds. Heating surface, 3,878 square feet. Diameter of driving wheels, 7.1 inches.

New Pacific type passenger locomotive for the Roumanian State Railways.

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Tuning Up the Cup Defenders

THE completion at Newport on August 18th of the series of races between the cup defenders, which was held under the auspices of the New York Yacht Club and the Newport Yacht Racing Association, marked the close of the first stage of the tuning up trials of the three boats which have been built to defend the "America's" cup The yachts met for the first time on June 2nd, and it was intended that thereafter, during the following six weeks, there should be a practically continuous series of trials. The weather, however, was by no means favorable, and the necessity of withdrawing the yachts temporarily for changes and adjustments made considerable inroads on the programme, with the result that, as a whole, the races thus far held must be considered to have been rather disappointing The most satisfactory trials were the three races held off Sandy Hook, when the winds were of reasonable strength and fairly constant. It must be admitted, though, that the average weather conditions were such as are liable to obtain three days out of four *off the Sandy Hook course in September; and, therefore*, to this extent, the results of the trials may be considered to give a satisfactory line upon the respective merits of the three yachts.

As thus far developed, the strong and weak points of the three cup defenders are in remarkable agreement with the predictions which we made in our issue of May 2nd, when we published the plans of the boats; but it must be remembered that, prior to the meeting of the candidates, "Resolute" had been afloat for about one month, during which she had been subjected to a very thorough tryout. Although, during the six weeks of racing, "Resolute" has won the majority of the contests, her closest competitor, "Vanitie," has shown a steady improvement, gradually, whenever the wind held true, cutting down the margin by which she has been beaten In three of the races "Resolute" has won only by virtue of her time allowance, and it begins to look as though the Cup Committee, when it comes to make the final selection, will have a very delicate task in choosing between the two yachts.

"Defiance," which has been withdrawn by her owners, in her last two or three races had begun to show a surprising and, in view of her early failures, a totally unexpected improvement of form, and particularly to windward in light breezes. That she could make such further development as to be a serious contender with the other two yachts was unlikely, particularly in view of the limited time that remained before the actual cup races, which start on September 10th.

The "Resolute" has proved to be a remarkably well-balanced yacht, excellent on all points of sailing and phenomenally fast in light airs. Her best work, relatively, has been done in going to windward, and the lighter the wind the greater the ease with which she has drawn away from her opponents Much of this advantage, however, is due to the admirable manner in which she has been sailed by her Corinthian skipper, who is in absolute charge of the yacht during her races. Almost invariably she has been first over the line and in the windward position, consequently she has reaped all the advantages which come to a leading yacht, particularly when the winds are light and fluky. In reaching, her performance is below the average of her work on other points of sailing, but up and down the wind she is a truly phenomenal boat.

"Vanitie," as we predicted, shows to best advantage with started sheets; and in reaching, particularly if there is weight in the wind, she is decidedly the fastest boat of the three. In windward work, however, she has shown a steady improvement, and the substitution of a gaff and club-top-sail spars of aluminium for those of wood, and the removal of loose ballast have added considerably to her speed, particularly in light airs. In future races, if the "Vanitie" should be handled with more snap and daring in the maneuvering at the start, and captures her share of the windward positions, it will be nip and tuck between her and "Resolute" for the rest of the season, with the chances in "Vanitie's" favor if strong breezes should prevail.

It is not stretching the point too far to say that the cup defenders of the present season are phenomenal boats. So far as the larger displacement, sharper form and smaller initial stability favored by the new rules are concerned, they not only seem to have done nothing toward reducing speed, but on the contrary have led to the production of exceedingly fast yachts, that are at once light and stanch in construction.

Of the speed of the cup-defending boats in light to moderate yachting weather there can be no doubt whatever. We believe that they could hold their own under these conditions with the 90-foot yachts of the last series of races, and that they might even beat them, boat for boat, without time allowance. In strong winds they would be overpowered. It is just here that this year's boats should cause some uneasiness to the Cup Committee; for unquestionably they are both rather tender. "Defiance" was notably so.

"Shamrock IV," on the other hand, although she carries a much loftier rig, proved to be so stiff that five tons of lead have been taken from her keel. She has been tried in wholesail and reefing breezes, and carried her big sail spread in good shape. It is questionable if either "Resolute" or "Vanitie" could hold her under these conditions; but that she will be able, even in her favorite weather, to save her large time allowance is very doubtful.

Safety First for Automobiles

ONE of the most humanitarian movements undertaken in the broad field of transportation is the present very successful "safety first" movement among the railroads. It is a voluntary effort, conceived and carried out by the railroads of this country, endorsed by the management, appreciated by the employees, and already, as statistics clearly prove, it is resulting in a great saving of life and prevention of injury.

In view of the enormous increase in automobile traffic and the ever-growing daily list of fatalities and injuries, there is a movement on foot in this city to extend the "safety first" principle to the automobile. One of the most prolific causes of accidents is the grade crossing, and nowhere has this menace to the users of automobiles rolled up such a total of killed and wounded as on the crossings of the Long Island Railroad.

We are in thorough agreement with the New York *Herald* in its agitation to bring about safer conditions on Long Island, and it is gratifying to learn that the matter of safeguarding these points of danger is being taken up by several influential bodies, including the various automobile organizations, the Safety First Society of New York, and the officials of the Long Island Railroad itself.

We understand that the railroad contemplates issuing an order to all watchmen and gatemen, ordering that crossing gates be kept closed constantly, and be raised only to allow automobiles and other vehicles to pass. There is nothing novel in this practice; for it already prevails in certain parts of France and England, where it has proved a very effective safeguard to highway traffic. Of course, such an order would have to be issued with discretion, that is to say, with certain limitations; and it could hardly be put in effect at certain points where the traffic is unusually heavy. Such cases, however, would be the exception rather than the rule, and there are hundreds of crossings, not merely on Long Island, but throughout the country, where a "normally closed" order could be put into effect without any serious hindrance to vehicular traffic.

Another practical and very valuable suggestion is that distant signs or signals should be erected a sufficient distance from the railroad crossings, to give the automobile drivers warning that they are approaching the tracks. Distant signals are an essential part of the railroad block signal system, and the arguments in favor of their use on the railroads are fully as forcible when applied to highway traffic. It is suggested that the expense for the proposed warning posts and night signals should be borne jointly by the railroads, the State Highway Commission, and the various counties affected.

Small-boat Cruising of the Atlantic

THERE is no reason why the proposed crossing of the Atlantic by a 30-foot Lundin motor boat should not be successful. There are those indeed, like Thomas Fleming Day, the veteran yachtsman, who claim that, with good seamanship and navigation, there is no greater danger to a small than there is to a large boat in making a long cruise, varying only surely Mr. Day ought to know. The editor of the *Rudder* believes that our yachtsmen are losing half the fun of yachting by keeping too closely to sheltered waters; and as for the danger, he claims that the greater the offing from land, the less the risk. To prove that he had the courage of his convictions, Mr. Day, a few years ago, started from America in a 26-foot decked yawl of his own design, and sailed the little craft successfully to Europe, making his final mooring in Rome itself, without any mishap whatsoever. Later he repeated the trip in a small motorboat.

The "Lundin" is a motor lifeboat of the type which has been developed since the "Titanic" disaster. It has the broad, shoal body which characterizes boats of this name, is almost completely covered in by a plate-steel cabin, and is provided with a double bottom. The craft is self-bailing and self-righting, and its engines are of sufficient power to give it a speed of about seven miles per hour. Like the Thornycroft motor lifeboats on the "Aquitania," it has a wireless outfit capable of transmitting and receiving over one hundred miles. If the projected trip is made successfully, it will serve to establish the merits of a type of craft two or more of which form the part of the lifeboat equipment of every modern liner.

Another View of the Origin of Life

THE origin of life, and the part probably played by sunlight in this process, formed the subject of a paper by Prof. Benjamin Moore, F.R.S., and Mr. Arthur Webster, presented at the last meeting of the British Association, in which the authors reported the results of extensive laboratory experiments which appear to have a bearing on the question. They first pointed out that the whole world of living plants and animals, as we know it, depends for its continuance upon the synthesis of organic compounds from inorganic by the green coloring matter of the plant acting as a transformer of light energy into chemical energy. However, chlorophyll, which acts as the transformer, is one of the most complex of known organic substances, and therefore represents an advanced stage of evolution. Starting from a purely inorganic world, without a trace of organic matter, what is the first step in the production of the latter? The authors find that when dilute solutions of colloidal ferric hydroxide, or the corresponding compound of uranium, are exposed to strong sunlight, or the light of a mercury arc, there are synthesized the same organic compounds that are at present formed as the first stage in the process of organic synthesis by the green plant, viz., formaldehyde and formic acid. As a planet cools down, first only elements would be present, then binary compounds, and next simple crystalloidal salts Then, by the union of single molecules into groups of fifty or sixty, colloidal aggregates would appear. As these colloidal aggregates increase in complexity, they also become more delicately balanced in structure, and are metastable or labile, i. e., they are easily destroyed by sudden changes in environment, but are peculiarly sensitive to energy changes, and can take up energy in one form and transform it to another. These labile colloids take up water and carbon dioxide, and, under the action of sunlight, produce the simplest organic structures. The latter, reacting with themselves and with nitrogenous inorganic matter, continue to build up more and more complex, and more labile, organic colloids, until ultimately these acquire the property of transforming light energy into chemical energy. Thus life has originated, and probably still originates, by the "law of molecular complexity."

Measuring Turbine Steam Consumption.—For the steam turbine with surface condensing, it is an easy matter to check up steam consumption by weighing the amount of condensed water. An automatic device is now installed in the well-known Allgemeine turbine establishment for automatic weighing and recording of condensed water of a turbine plant, consisting of two measuring tanks mounted upon pivots, with a water feed placed above them. One tank fills up by water flowing down into it, and when full, it tips over to some extent and allows the water to flow out by a pipe, at the same time shifting the feed stream upon the second tank, and so on. At each movement of the two tanks there is made a record in a suitable way, the whole being quite automatic. The device affords an excellent means of determining steam consumption of a turbine, either upon special tests of new machines or for the regular running of a turbine plant.

Science

Curative Baths for Rheumatism.—At a recent session of the Academy of Medicine in Paris, M. Barthe de Sandfort describes the happy results obtained in certain cases by the use of waxy envelops raised to a temperature of not less than 50 deg. Cent. The mediums used were the mineral waxes (paraffine, ambrine, etc.). These maintain a temperature above 43 deg. Cent. for 24 hours without being renewed. They give excellent results in rheumatism, gout, arthritis, lumbago, sciatica, etc. The author likewise covers wounds, ulcers and burns with a paraffined mixture (ambrine) raised to 80 deg. Cent. or more, which in passing from the liquid to the solid state instantly forms a protective and sterilizing shell over these losses of substance in whose shelter the tissues rapidly heal.—*Cosmos.*

An American Precursor of Darwin.—The curious coincidence which led Darwin and Wallace to hit upon the same theory of evolution at about the same time, is heightened by the fact that a little treatise, published by an American, C. W. Sleeper, at Boston, in 1849, contains the fundamental principles of the theory. Darwin first had the idea in 1842, but it was not published till 1856. Sleeper's brochure has been sent to England by an American gentleman and will receive the attention of the Linnean Society of London. In it, one finds not mere vague anticipations of the theory, but definite statements such as "everywhere around us we see the pitiless struggle for life, the useless perishing, the useful persisting and progressing," and farther on "man and the ape descend from some common type," etc.

Sanitation in West Africa.—On the occasion of unveiling relief portraits of the late Joseph Chamberlain and his son, Austen Chamberlain, as a memorial to the work done by these officials on behalf of tropical medicine, Mr. Harcourt, the British colonial secretary, gave an account of the results accomplished by the London School of Tropical Medicine. Aside from the discoveries made in its laboratories, it has benefited humanity by sending its students abroad to countries where their special knowledge and skill was most needed. Perhaps the most striking example of the progress made in tropical medicine is the west coast of Africa, a region notorious beyond almost all others for deadly climatic conditions. In the past ten years, the death-rate among British officers on this coast has been reduced from 28 to 8 per 1,000, and the invaliding rate from 62 to 28.

Guilbert's Weather Forecasts.—In a communication to the French Academy of Sciences, M. Gabriel Guilbert reports the results that have attended the application of his empirical method of weather prediction in a series of no less than 9,000 forecasts, published in a Parisian newspaper. This method of forecasting, which seeks an indication of coming changes in barometric pressure, such as the paths of cyclonic disturbances, from the observed relation between the force and direction of the winds to the force and direction appropriate to the existing isobars and barometric gradients, was first announced by its author in 1891, and attained great prominence among meteorologists when M. Guilbert won the prize in a weather forecasting competition held in connection with the international exposition at Liège in 1905. In the series of forecasts above mentioned, it is claimed that the movements of cyclones in all parts of Europe were correctly forecast 24 hours in advance in 89 per cent of the cases; variations of pressure in 86 per cent; and weather conditions in more than 80 per cent. It is claimed, moreover, that nearly all the failures were due, not to the method of prediction, but to the sparsity of weather reports from certain regions or other analogous causes.

Laboratory Studies of Halos.—Of the very numerous recorded forms of solar and lunar halos, several are excessively rare; some, in fact, have been reported only once or twice in the history of science. Moreover, such phenomena are commonly of brief duration (sometimes lasting only a minute or two), and so local in occurrence that the individual student of halos may hope to see only a few of the rarer forms in the course of a lifetime. Thus it is said that the French meteorologist Renou, who searched the sky constantly for halos during fifty years, was never rewarded with a glimpse of the oblique arcs of the anthelion, the halo of Hevelius, the paranthelia of 90 degrees, or of several other rare forms. It is no wonder, therefore, that the theory of halos is still fragmentary. At a recent meeting of the Meteorological Society of France, M. Lemoine suggested that this problem might be attacked profitably from the laboratory. The various forms of ice crystal occurring in nature might be produced artificially, and their optical properties could then be studied under favorable conditions. Such an undertaking would probably throw much light upon the mode of occurrence and the precise shape and position of many of the rarer halos, and is well worthy of attention on the part of physicists. Various other moot questions in atmospheric optics might also be investigated in the laboratory, e. g., the question recently raised by Bergeron as to whether ice crystals are able to produce corona, as was formerly generally believed, or whether these phenomena are not always due to droplets of water.

Aeronautics

New Altitude Record with an Aeroplane.—On July 9th, at Johannisthal Aerodrome, near Berlin, Germany, Otto Linnekogel soared to a height of 21,654 feet, or 4.1 miles in his monoplane, said to be the highest altitude record yet attained by an aeroplane.

Braced Aeroplane Surfaces.—A patent, No. 1,105,510, to John George Aulsebrook Kitchen and Isaac Henry Storey, of Lanchester, England, provides a special construction of plane supporting surfaces, whereby to secure greater rigidity, compactness of form and stability.

Reinforced Gas Containing Envelope.—In a patent, No. 1,100,762, issued upon the invention of Hermann Neatz, of Bitterfeld, Germany, is provided a special means for strengthening and reinforcing the gas containing envelopes of airships transversely for the purpose of preventing them from becoming deformed, especially at their overhanging ends.

A Novel Parachute Attachment.—Otto Kroop, of West Hoboken, N. J., has secured patent, No. 1,101,196, for a parachute attachment for aeroplanes, including means for effectively and practically instantaneously setting the parachute in operative position irrespective of the angle at which the aeroplane may be tipped, either longitudinally or laterally.

Promised Development of Army Flying Corps.—Having available July 1st an appropriation of $250,000 for aeronautics, Brig. Gen. J. P. Sorrven, Chief Signal Officer, and Asst. Chief, Lieut. Col. Samuel Reber, have prepared plans looking to a competition by the builders and inventors of aeroplanes in America. It is expected that large purses will be offered and that the competition will take place at San Diego, Cal., during October and November.

The Military Value of Cross-country Flying.—Cross-country flying forms, perhaps, the most important part of a pilot's training, but in practice opportunities for making long cross-country flights are rare. Accordingly, in Germany, military pilots are encouraged to compete for the manifold competitions instituted by the National Aerial Committee. Cross-country races are held, in which both civilian and military competitors take part, while in all the big races a military observer is carried as passenger.

Sikorsky Aerobus Records.—According to the daily press, the Russian aeronaut Sikorsky is making some remarkable flights with his great aeroplane, or "aerobus," especially in the way of carrying numerous passengers. The following new records are listed. On June 19th, he mounted with 10 passengers on board to a height of 2,000 meters (6,200 feet) in 1 hour 26 minutes 21 seconds; and during the night he made a flight with 6 passengers which lasted for 6 hours 33 minutes 10 seconds. The aeroplane is fitted with two Salmson motors of the 200 horse-power type.

Aircraft v. Submarine.—It is undoubtedly true that, under certain conditions, it is possible from a good altitude to perceive objects at a certain depth below the surface, but this is mainly the case with calm, clear water, with a favorable light. In the choppy grey waters which abound round British coasts, a submarine would rarely be detected, more especially as the view from the pilot's and observer's seats is, in the majority of cases, most defective at the present time, and the fierce slip-stream from the propeller revolving in front, added to the high speed of travel, render the use of goggles imperative. But, in the opinion of a writer in the London *Daily Telegraph*, minor difficulties such as these may, and no doubt will, be overcome in time, and experience alone can show in how far the aeroplane will serve as a protection against submarines.

Status of the British Industry.—On the whole, the British aviation industry may be said at the present time to be in a more satisfactory condition than ever before in its brief existence, according to the London *Daily Telegraph*. There is first the growth and development of aviation itself, involving a natural expansion of the industry. In the second place, there is the remarkable increase in the effective strength of both branches of the air service. The military wing at the present time possesses five squadrons, each of which has nearly been brought to its full establishment strength, both in men and machines, and, more important still, in transport material, though adequate reserves and the requisite stock of spare parts are still, it is to be feared, lacking. These squadrons, completed by some additional flights, are now mobilized and engaged in concerted manœuvres on Salisbury Plain. They comprise, roughly, about seventy effective aeroplanes, which is not wholly unsatisfactory for the time being, though, including reserves, the full establishment strength of the eight squadrons, which, on paper, constitute the military wing, amounts to no fewer than 200 aeroplanes, irrespective of those required for tuition at the Central Flying School. It must be remembered, and the fact is at last obtaining recognition in official quarters, that for every aeroplane in commission there is one lying up; it is this exceptionally heavy wear and tear that necessitates such unusually large reserves.

Inventions

Stenographic Writing Machine Patents.—A number of patents, Nos. 1,098,113 to 1,098,118, inclusive, have been issued to Ward S. Ireland, of Owensboro, Ky., for sundry improvements in stenographic writing machines.

Electrical Heater for Concrete Buildings.—William S. Haddaway, Jr., of New York city, has patented, No. 1,098,436, an electric heating system adapted for heating concrete buildings, and in which the metallic reinforcements are utilized as elements of the heating system.

Putting Indoors for the Golfer.—Carl J. Leudor, of Mount Vernon, N. Y., has secured patent 1,101,203 for an indoor golf putting cup providing a device by which a golfer may practice indoors in such manner as to improve his play upon the actual putting green.

A Charles Francis Jenkins Patent.—Charles Francis Jenkins, of Washington, D. C., has secured patent, No. 1,098,805, for an internal combustion engine, providing a two-cycle engine in which the fuel supply may be reduced to any practically desired extent without danger of missing explosions or introducing any harmful features.

Fire Protection in the Patent Office.—After consideration of other systems of fire protection, contract has been awarded for the installation in the U. S. Patent Office of an automatic sprinkler system for the protection of some of the valuable records stored in or upon inflammable supports, especially at points where the fire danger seems greatest

A Veteran Patent Office Examiner.—Dr. A. G. Wilkinson, the dean of the corps of Patent Office examiners, celebrated the fiftieth anniversary of his connection with the office on July 1st, 1914, receiving the congratulations of the Commissioner and his official associates. His first assistant, Mr. Wm Hutchinson, with forty-seven years in the office to his credit, is not far behind the Doctor in point of service.

A Device for Cleaning Bottles.—The great difficulty in removing deposits from the inside of bottles is well known, and often they have to be discarded for this reason A Swiss inventor makes an ingenious device in the shape of a rather large metal basin with a middle upright tube. Sand is put in the basin, and a hose connects with the water supply. A simple arrangement allows of projecting sand and water into the bottle which is fitted over the tube, and this cleans it effectually. When the sand can be stopped and the operation finished with pure water.

How to Remove Air from Wine Bottles.—To keep wine properly, the liquid must actually touch the cork, for any air that is compressed here by corking the bottle is very injurious. Air can be removed by taking a small copper tube about the size of a quill and filing it so as to make a semi-tube, then fixing a thumb ring at the top and sharpening the bottom end Place the tube in the neck with the flat side against the glass, and the cork is driven in so that the air comes off through the tube. When corked, the tube is withdrawn and no air is left in the bottle.

Photographing Yourself at a Distance.—A curious method of photographing oneself when at quite a distance from the camera is proposed by M. Morisot. Take a wood spring clothespin and shape out one end so that it grasps the bulb of the shutter and the spring tends to press on the bulb. Then the other ends are brought together so as to release the bulb, and are tied with string or thread. On this is put a piece of fuse of some length. Lighting the fuse, the person goes to the distant point before the camera, and when the string is burned the clothespin presses the bulb and makes the exposure

Seeing by Wire.—The sensational paragraphs which have been appearing in the press on seeing by wire are somewhat misleading. There is no indication of anything fundamentally different from the plans which were put forward in the early days of the Physical Society of London, when the late Mr Shelford Bidwell, Prof. Ayrton, and others, were experimenting with selenium. At that time, masses of selenium were going to do all that is promised now, but they never did. It may be that Dr. A. M. Low, whose apparatus has been described in the daily press, has made some progress, but the published accounts of the invention as "the latest scientific discovery" are absurd

Wireless Telephony.—An article in the Paris *Matin* which has excited much interest refers to some interesting experiments in wireless telephony carried out by Capt. Colin, of the French Navy, who has been at work on the subject for some years in collaboration with Lieut. Jeance. The details of the apparatus are not given, but it would appear that some improvement has been made in the direction of maintaining steady and continuous oscillations at the transmitting end. Speech, it is stated, has been transmitted from Paris to Finisterre, a distance of 300 miles, and a type of field apparatus with a mast about 90 feet high has, it is said, been developed, which can be unloaded from a motor-car and set to work by a crew of six men in twenty-one minutes, and will transmit without difficulty over a distance of from 60 to 120 miles.

Ten Times Greater Than the Old

NEARLY every regular traveler across the Atlantic becomes attached to some favorite steamer on which he voyages frequently, and which he constantly recommends to his friends. The White Star liner first to bear the name "Britannic," launched in 1874 and employed regularly in transatlantic crossings until 1899, was in the fullest sense of the term a favorite vessel, and is remembered pleasantly by scores of thousands. The second steamer to bear this illustrious name is a giant, ten times larger than her predecessor, which is now nearing completion at Belfast.

The birdseye view reproduced herewith is from a photo of actual models of these steamers which our artist has deftly placed in the water, and they demonstrate vividly the rapid strides made during the past four decades in the fine art of ship construction. The newer and greater "Britannic," 50,000 *tons, largest of* all British steamers, will enter service next spring.

The "America's" Developments of the Past Week

By the Staff Correspondent of the Scientific American at Hammondsport

WHEN Mr. Curtiss had finished testing the open sea-sled bottom attached under the "America," as described in the SCIENTIFIC AMERICAN of last week, he and his associates were pleased and hopeful for better results in succeeding trials. He was now urged by the practical aviators to board up the sides and rear end of the sled-like raft, so as to exclude the water, impart shallow draft, and cause the craft to skim promptly over the water's surface, without having first to be raised from her former deep wallow.

The new bottom measured, in ground plan, 13 feet long by 7 feet wide, was well turned up in front, to mount the water readily, and was hollowed under the fore part, but nearly flat at the rear part, which terminated flush with the step of the hull. Looked at hurriedly, this arrangement seemed good to the uncalculating; there was ample buoyancy and a fine planing surface. The practical fliers who had urged Mr. Curtiss to this form of the sea-sled expected the craft to mount the water and plane better than anything yet tried. But as the center of gravity was at the rear of this huge 500-pound barge, while the center of buoyancy was nearly two yards farther forward, the bow rose and the tail sank. The full thrust of the propellers could neither level the craft nor beget speed enough to make her mount. A submerged planing fin was fixed at a large angle under the stern, but without avail. She would neither lift her tail from the water nor mount and skim. Mr. Curtiss, who at no time had relished this ponderous and costly addition, brought the airboat ashore and held a brief conference with his aviator and constructors.

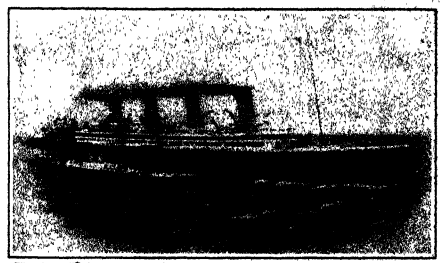
After considering the many ways that had been tried, and might still be tried, to make the twin motors and attached propellers lift the desired 5,000 pounds to the water surface, so that the boat might plane swiftly on her bottom and rise into the air, it was decided to forego for the present trying further novel devices. Curtiss proposed to add a third 90 horse-power motor, like the others, with a direct connected propeller, and to add beside the bow the early planing fins which had proved so efficient shortly after the "America's" launching. With these fins and two engines nearly 4,400 pounds total weight had been lifted, and carried in successful flight. It was thought that the third engine might add 1,500 pounds lift, 1,000 pounds of which could be available for carrying gasoline.

After discussing the various possible locations for the third motor and propeller Curtiss decided to mount them on top of the upper plane, near its center of lift, the propeller to jut forward of the leading edge and send its stream back parallel to those of the twin propellers without damage to the original arrangement of propellers and control surfaces. He would take chances on the disturbing effect of such a high thrust. If the craft should rise and fly with an extra thousand pounds of fuel, the third motor might be allowed to work during the early part of the voyage, and later be held in reserve. Possibly ways could be devised to diminish or eliminate the resistance of the idle propeller. These improvements were ordered on Saturday night, with the hope of a trial on the following Tuesday, July 21.

On July 23rd the "America" rose from the water and actually flew, with the assistance of the third motor which had been fitted in place. So long flight was attempted, as the object of this brief trial was to get her to lift from the water with her full load, which has been the result sought for in the long series of experiments made with the craft since she was launched. If it is found on further trial that the "America" can fly with two of her engines running, after rising from the water, she will be considered perfect, and ready for her great effort.

In this latest trial the total load lifted was 6,203 pounds, which is approximately in excess of what she will be expected to carry on her long flight, and provides a margin for additional fuel for the third motor.

Including its third engine and underplaning surfaces the "America" weighs 3,500 pounds, and on her transatlantic flight her cargo is estimated as follows: Lieut. Porte, 168 pounds; Mechanician Hallet, 145 pounds; gasoline, 1,800 pounds; engine oil, 176 pounds; food and instruments, 100 pounds; a total of 2,389 pounds.



The first "Britannic" (*of the 70's*) compared with the "Britannic" of 1914. Both ships drawn strictly to scale.

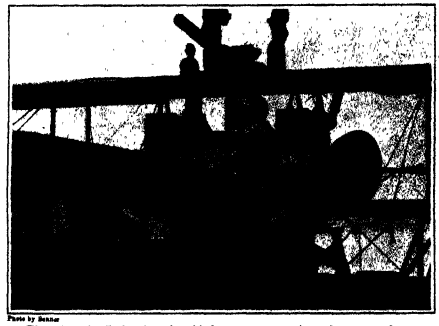
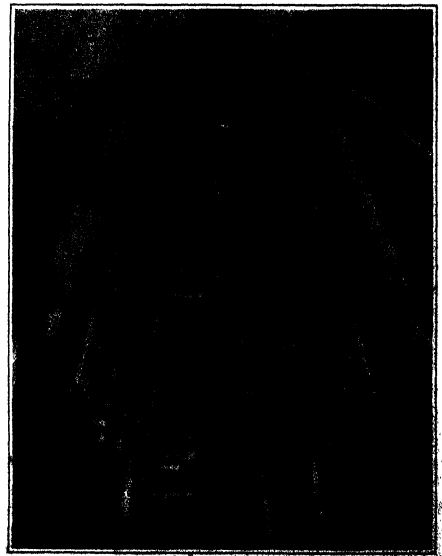


Photo by Bonine

The "America," showing the third motor mounted on the upper plane.



The 1,200 horse-power engine of the "Disturber IV."

Cottonseed Meal as a Substitute for Meat

THE increasingly high price of meat is stimulating the search for other foods supplying the protein that is obtained from meat in the ordinary diet. Experiments recently carried out in Texas by J. B. Rather point to cottonseed meal as a promising food in this connection. This cheap substance is extremely rich in protein. Mr. Rather finds that a pound of digestible protein is twenty-one times as expensive in eggs and fifteen times as expensive in meat as it is in cottonseed meal. Numerous experiments in the use of this food were made on human subjects. It was found that the meal could not be used alone, but, in order to be palatable, had to be mixed with corn meal or wheat flour, the cottonseed meal forming not more than one fifth of the mixture. In this form it was made into bread, muffins, cake, etc., by the ordinary recipes. In the dietary, however, it does not occupy the place of bread or cake, but of meat, which should be partly or wholly dispensed with when the cottonseed meal is used. Diluted as above described, few people will be able to eat more than two ounces of cottonseed meal daily. In addition to protein, cottonseed meal contains nearly as much digestible fat and carbohydrates as beef flank, and more than beef loin or leg of mutton. Whether the long-continued use of this food, to the complete exclusion of meat, would be healthful is, for the present, doubtful, in view of the well-known and still mysterious toxic effect of cottonseed meal when used in large amounts and for a long period in feeding stock.

America's 1,800 Horse-power Motorboat

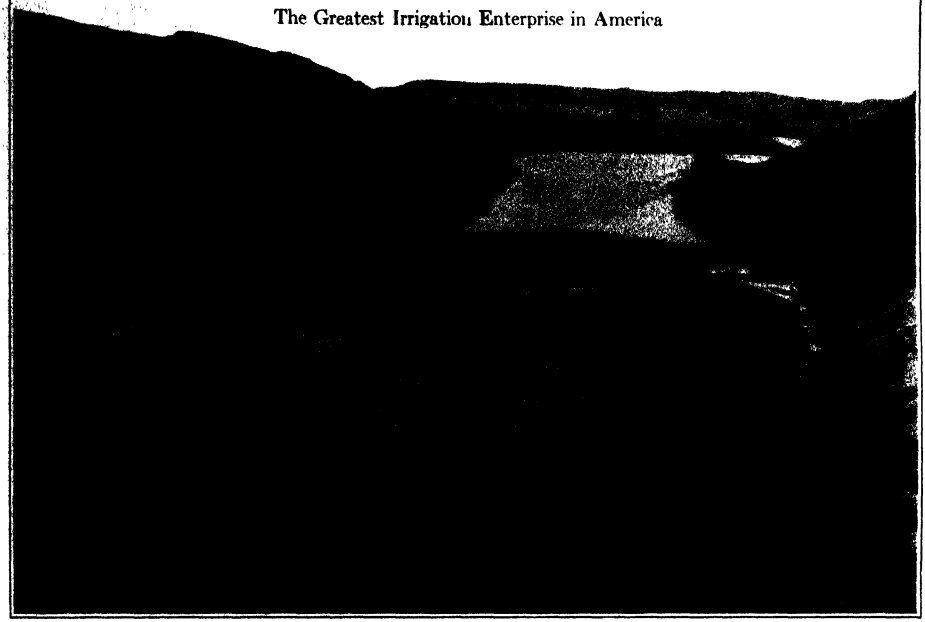
THE only American entry in the international motorboat races for the Harmsworth trophy, which are to be held in England this month, is the "Disturber IV." It ought to make a very good showing, for it is the highest powered racing boat that has ever taken the water.

The "Disturber IV" was built for Commodore Fugh of Chicago. It is 39 feet 11 inches long, and is fitted with two special engines, one at each side of the boat. Each engine has twelve cylinders of 6¾-inch bore by 7½-inch stroke, and has a rated capacity of 900 horse-power, that is, a total of 1,800 horse-power in the whole power plant. Overhead valves are used, the exhaust pipes running over the tops of the cylinders, as shown in the photograph.

The ignition system is the most complex that has ever been placed on an internal combustion engine. There are twelve 4-cylinder magnetos, each supplying two sparks at a time, providing altogether ninety-six spark plugs. At the time this photograph was taken the engine presented a rather tangled appearance as the work on it was not yet well under way.

The Elephant Butte Dam

The Greatest Irrigation Enterprise in America



Length, 1,200 feet. Maximum height, 300 feet. Maximum width at base, 215 feet. Capacity of reservoir, 2,642,292 acre-feet, or 862,000,000,000 gallons.
Elephant Butte Dam. Rio Grande project.

THE Elephant Butte project in Southern New Mexico, eighty miles north of Las Cruces, is rapidly nearing completion, and will begin to store water the coming winter and spring.

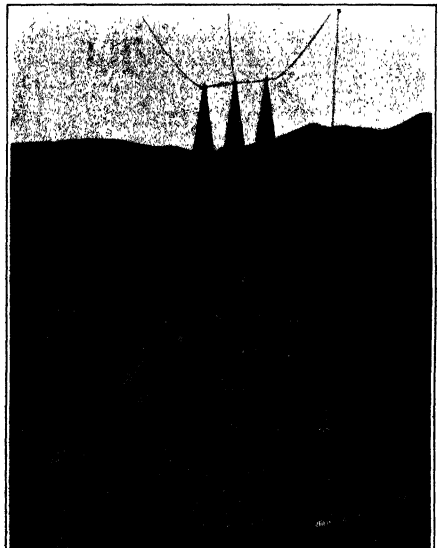
This is the most notable project of the United States Reclamation Service for the reason of its inter-state, international, and engineering features. It will bring into cultivation 180,000 acres of land, 155,000 of which are in Southern New Mexico and Texas.

The completion of the Elephant Butte Dam and the storage of water, which will bring to pass the resurrection of this fertile soil of the Rincon and Mesilla Valleys in New Mexico, one of the only sections, if not the only section, of the United States that rivals the valley of the Nile will be the biggest work of its kind that has ever taken place to further the development of the Southwest and to focus the eyes of our country upon this part of the United States.

These valleys are the oldest irrigated districts in our country. Even before the arrival of the English colonists in the United States, the Spanish explorers were invading this section from Mexico, building missions and founding towns that remain as monuments to their advance and settlement. Besides the ruins of these towns and missions, there remain signs of the agricultural developments that exhibit what had previously been done with the soil of this region. The old vineyards, it is stated, compared favorably with the finest in France and Italy.

It is a striking and fitting coincidence that here in these valleys, after more than four hundred years of irrigation in one form or another, should be found the location of the biggest and finest irrigation project in the entire country.

The pertinents of the Elephant Butte Dam, as regards its dimensions, are as follows:



Construction of the Elephant Butte Dam, containing 550,000 cubic yards of masonry.

The length of the dam will be 1,200 feet.

Width of the roadway on top will be 18 feet

The maximum height of dam will be 300 feet.

Maximum width at base, 215 feet.

It will have twelve water gates.

There will be 550,000 cubic yards of masonry in the structure

It will create a reservoir 45 miles long, submerging 40,000 acres of land. The artificial lake which will be formed by the dam will be the largest of its kind in the world. The capacity of the reservoir will be 2,642,292 acre-feet of water, an acre-foot being enough water to flood one acre of ground one foot deep It will contain 862,000,000,000 gallons of water

This water, if spread out one foot deep, would cover more than 4,128 square miles, or an area of over twice that of the State of Delaware It would fill a pipe 4 feet in diameter, 1,734,700 miles long, or nearly seventy times around the world. It would fill one hundred canals 20 feet wide and 4 feet deep, stretching from New York to San Francisco.

The maximum depth of water near the dam will be 193 feet, and the average depth of water 66 feet

In building the dam, it was necessary for the Government to construct 19½ miles of roadway, 21 miles of telephone line, 7½ miles of power line, and 13 miles of railway. The cost of the project will be $7,200,000.

The annual flow of the Rio Grande at the dam is 800,000 acre-feet The lands comprised in this project will require for their irrigation only 600,000 acre-feet per annum. After figuring in every possible source of expenditure, waste, and depreciation, there will be left in the reservoir

for emergencies, after it has once been filled, not less than 1,400,000 acre-feet, or more than enough water to irrigate the entire acreage during more than two years of total drouth. This latter statement will probably give the most adequate idea of the immensity of the dam and the wonderful storage capacity of water for irrigation which it will provide.

With water in the big Elephant Butte Reservoir, the farmer in the Rincon and Mesilla Valleys of New Mexico will be master of his land. Farming will be changed from "chance" to "certainty"—no drouth can cause loss, for he will have his own water factory. No floods will occur, for he will control the flood gates.

In the neighborhood of 60,000 acres of this land are being irrigated at the present time from community ditches which take their water from the flow of the river. Some very fine crops are being obtained, and they are illustrations of what can be done and suggestions of the greater things that can be expected with water behind the dam.

It is not claimed that these valleys will produce fabulous crops without labor. Here, as elsewhere, the soil will not yield its best returns without proper work and proper cultivation. The claim is made, however, that with proper cultivation the land of these valleys will produce results equal, if not superior, to any to be had from the richest irrigation districts in the world.

Alfalfa is the leading crop at the present time, and from four to five cuttings, and from one to two tons to the cutting are obtained. Wheat yields from 25 to 45 bushels per acre and corn from 60 to 75 bushels. The valleys are ideal for the growing of fruit and truck, and these are the crops that will replace all others in the future years, as this land will ultimately become too valuable for the growing of such crops as alfalfa, corn, and wheat.

Las Cruces is the principal city of the valleys, with a population of 5,000. It is a modern, up-to-date city with all public utilities and churches of all denominations. It has an unusually fine school system, and in addition to the public schools, the Loretto Academy, conducted by the Sisters of Loretto, is located in Las Cruces, and the State Agricultural College, which is a very big asset to the valleys, is located at Mesilla Park, two and one half miles from Las Cruces.

Recently a big and magnificent work was inaugurated by the Elephant Butte Water Users' Association, an association of the farmers, in the forming of a publicity and immigration campaign, not for any financial return, but to give out full and accurate information in regard to the project and the valleys and to help the man who wishes to obtain a location here to get settled, and to help him in every way possible after he becomes a neighbor.

In addition to the help of the Water Users' Association, the United States Reclamation Service, which is building the dam and is now in charge of the construction of the entire project, stands ready to render every possible assistance to the newcomer, and their stamp of approval, from their many years' experience in such matters, is on all this work, the Water Users' Association work included.

In mentioning the Elephant Butte Dam and the thousands of acres to be reclaimed with the water which it will store next spring and the great development which it will bring to the Southwest, perhaps the greatest charm of this section after all, lies in its climate. The average elevation is about 4,000 feet. There are 325 recorded days of sunshine out of the 365. The temperature does not go below zero, and averages in the neighborhood of 78 during the spring, summer, and fall. The purity of the air and the almost perpetual sunshine make it the ideal climate for the invalid from lung trouble. It has been pronounced by a body of medical experts from Europe who visited all sections of the globe and reported to the French Medical Congress that the valleys in New Mexico (now coming under the Elephant Butte Dam) were as nearly ideal as an all-year-round climate as could be found in the world.

So, after hundreds of years of crude irrigation by the ancient Pueblos, the early Mission Fathers, and early Americans, and having been for many years entirely forgotten, these valleys once more will break into beauty and bloom.

Trucking a Radio-telegraphic Outfit

IN a recent march from Fort Myer, Va., into Pennsylvania, the Third Field Artillery, U. S. A., had as part of its equipment a truck in which was mounted a radio-telegraphic outfit, the success of the wireless experiment being well explained in a message sent by the set from the commander, Major Charles P. Summerall, to the chief signal officer, wherein it is said: "Radio tractor has completed tests in every particular perfectly during march of 260 miles; no damage or delay occurred to tractor or equipment. Command always in communication with Arlington or New York after latter was called. It completely fulfills all requirements as means for maintaining communication over theater of operation and with distant stations."

The Anthony N. Brady Memorial Medals

THIS family of the late Anthony N. Brady has authorized the award annually by the American Museum of Safety of a gold medal to that American electric railway company which for the year of award shall have done most to conserve the safety and health of the public and of its employees. In addition to the gold medal awarded to the company, a replica in silver will be awarded to that member of the operating staff who has most contributed to the successful record of such company; and another replica in bronze will be awarded to that employee of the company whose services have been of the greatest value in the promotion of safety and health.

Conditions of Competition.

The following have been adopted as the conditions of the competition:

The competition shall be for the year ending June 30th, and the award for the first year shall be for the year ending June 30th, 1914.

Every company entering the competition shall file with the American Museum of Safety by the 31st day of August next after the close of the year the data upon which it founds its claim to the award. Such data for the year ending June 30th, 1914, shall be filed by August 31st, 1914.

Every competing company shall include data covering all lines comprising the entire system of which it is a part, without regard to technical ownership. The test ordinarily would be operation under the jurisdiction of a single president.

Such data shall include:

1. A report of all casualties to passengers, employees and others.

The terms used in this form are to be understood as follows:

Train miles run shall be the total of all revenue and non-revenue mileage made by motor cars or locomotives in all classes of service, except construction service. The mileage of single car operation is regarded as train mileage.

The number of employees for computing the rate per 1,000 in industrial accidents is determined by dividing the aggregate days worked by all employees in industrial service, such as track men, line men, station men, power house and substation men, freight handlers, and others not actually engaged in the operation of cars, by the number of working days in the period covered by the report.

Train accidents include all casualties resulting from collisions with other cars or trains, derailments, and miscellaneous accidents to trains.

Other than train accidents include all casualties resulting from accidents to roadway or bridges not causing derailments, as, for instance, fires, floods, land-slides, explosions, etc., also all resulting from collisions with vehicles, platform accidents, and other accidents connected with the actual operation of cars not including industrial accidents.

Industrial accidents include all accidents not involving train operation, but occurring to employees of the company on or about railway premises. Instances are: accidents occurring to employees while working on tracks, bridges or other structures, at stations, in or about power houses, substations, shops, barns, transmission and distribution lines. Railway premises include highways and other public property occupied under franchise rights.

Passengers include passengers on passenger, freight, and mixed trains or cars, and persons carried under agreement or contract, such as employees of express companies, postal employees, etc.

Employees include employees of the company competing, but not the employees of other companies carried under agreement or contract.

Other persons not trespassing include all persons other than passengers, employees, and trespassers.

Killed: Accidents to persons resulting in immediate death or in death within 24 hours from the time the accident occurred should be reported in columns headed "Killed."

Injured: All other accidents to persons, including those resulting in death of the person injured after interval of more than 24 hours from the time the accident occurred, should be reported in the column headed "Injured." Trivial accidents need not be reported. Accidents to employees shall be regarded as trivial if they result in injuries so slight as not to prevent the employee injured from performing his accustomed service for more than three days, in the aggregate, during the ten days immediately following the accident. Injuries to passengers and other persons that do not prevent the injured person from following his customary vocation for more than one day shall be regarded as trivial.

2. A report of the various measures taken during the year to conserve safety and health, including, among others, the following:

a. Block signals.
b. Protective devices at railroad crossings.
c. Protective devices at highway crossings.
d. Protective devices at other points of danger.
e. Automatic stops.
f. Safety devices in cars, shops, power houses, sub-stations, and in connection with roadway and transmission and distribution systems.
g. The separation of grades, the reduction of curves, and the elimination of obstructions to view.
h. The observance of high standards with regard to the inspection, maintenance and improvement of rolling stock, roadway transmission and distribution systems.
i. Standards of employment, physical, and mental.
j. Periodical examination of employees, physical and mental.
k. Rules and discipline.
l. Educational measures affecting the public, including school children.
m. Educational, protective and co-operative measures for and through employees.

Measures to Alleviate Injury of Accidents.

a. First aid to the injured, including appliances, and training of employees, and first aid contests.
b. Emergency and other hospitals.

Measures to Promote Health.

a. Attention to lighting, ventilation, cleanliness, disinfection, pure water, sanitary conveniences, and other factors affecting the health of passengers.
b. Attention to lighting, ventilation, cleanliness, disinfection, pure water, sanitary conveniences, and other factors affecting the health and welfare of employees.
c. Instruction of employees in matters of hygiene and sanitation.

3. A report showing the following facts in connection with the operations of the company for the year:

a. The single track mileage of all lines operated during the year.
b. The division of the track mileage into surface, elevated and subway lines respectively; also into urban, suburban, and interurban lines, respectively; showing also what part of the mileage is on the private right of way.
c. The number of revenue passengers carried, showing separately the number carried on surface lines.
d. The number of car miles run, showing separately the car miles run on surface lines.
e. The gross earnings per mile of single track in each class of service.
f. The amounts of earnings, both the amount set aside and that actually paid, on account of accidents occurring during the year, together with the ratio of such amounts to gross earnings.
g. The monthly average number of employees.
h. The especial difficulties, if any, physical, legal and other, affecting the safety of operation.

4. A report of all other facts regarded by the company as materially bearing upon the record for conservation of safety and health made during the year. Data for other years may be given under this heading.

The committee on award may ask for any additional data.

Heart Strain and Its Prevention

IN reading a paper recently on "Heart-Strain and its Prevention" before the Institute of Hygiene, Dr. J. Strickland Goodall drew attention to the enormous amount of work done by the heart. From before birth until, usually, a short time after death it beats uninterruptedly at rates varying from 70 to 150 or more contractions a minute, doing at each contraction enough work to raise a 2-pound weight through a foot. Some conception of the work done can be gaged by placing a 2-pound weight in the palm of the hand, resting the elbow, and raising and lowering the weight from the level of the elbow to the shoulder.

Acute heart-strain is difficult to produce in a young, well nourished, and healthy adult; but it is very easy to produce if the heart-muscle is anemic, poisoned, or the seat of degenerative change. When the heart is strained, it loses its power of doing extra work. Cases have been observed in which the heart had actually burst, and one case in which an animal had ruptured its heart and died from emotion. Heart-strain may be induced in some of the common, thoughtless actions of everyday life, as, for instance, in the action of running to catch a train. In an actual experiment made on a person with a healthy heart, before the run the heart-rate was 76 per minute, and the heart was doing 182 foot-pounds of work a minute; after the run the heart rate was 180 per minute and the heart was doing 860 foot-pounds a minute—an increase of 228 foot-pounds per minute. Great strain may also be imposed upon the heart by ascending stairs hurriedly.

Emotions affect the heart, and as a result of anger the work of the heart may be increased from 182 to 224 foot-pounds per minute. "Keep your temper" is, therefore, good physiological advice. When the cardiac rate and work are increased by strenuous exertions, it is not only during the actual exertion that the heart's work is increased, but extra work continues to be done for some time after the cessation of the exertion. The enormous amount of total extra work done by the heart is shown in the experiment of riding a bicycle uphill, the gradient being 1 in 10, the length 2,904 feet, and the time of the ride 8¼ minutes. In a tested example the extra work would have raised 1¼ tons through 1 foot.

The work of the heart could be economized in many ways. If one went to bed every night at 10 instead of 12, the heart would be saved 876,000 foot-pounds of work in a year; by lying down half an hour daily there would be an annual economy of 219,000 foot-pounds; an hour's rest every Sunday would save 62,400 foot-pounds; and by spending every Sunday in bed, instead of only sleeping eight hours, the saving in the year would be 998,400 foot-pounds.

Thermometers in Railroading.—The Lehigh Valley Railroad has just installed accurate thermometers, properly exposed in louvred wooden cabinets, at the principal railway stations throughout its system. The plan of maintaining such instruments enables a railway to furnish at any time to any part of the line and that can whether the temperature is sufficient for receiving certain classes of freight which are liable to injury by heat or cold.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Animals That Never Drink

To the Editor of the SCIENTIFIC AMERICAN:

Your note on page 407 in issue of June 20th, entitled "Animals That Never Drink," recalls my boyhood days when I lived on a farm in southern Michigan, in Lenawee County, near the Ohio line, with my father, who was a successful raiser of sheep. A flock of sheep would be confined in a pasture of 6 or 8 acres during the summer until the grass was eaten short, and then changed to another field for a few weeks at a time.

I noticed that the sheep had no access to water, no stream or spring or pond nor depression where water could accumulate in time of rain, and no water was supplied to them at any time, yet the sheep were fat and apparently in good condition.

I once called my father's attention to the absence of water, and asked how the sheep could live without it. He replied that they obtained sufficient water by grazing in the early morning hours when there was usually a heavy dew on the grass. The grass was often very wet with dew, as I had seen, and this, I believe, furnished sufficient moisture for the needs of the sheep.

Might not this explanation apply also to the case of the antelopes and the gazelles mentioned by Drs. Blanford and Drake-Brockman?

London, England. J. H. DARLING.

Some German Pioneers in Technical Education

To the Editor of the SCIENTIFIC AMERICAN:

I knew you will be fair and just to the many staunch friends of the SCIENTIFIC AMERICAN through taking notice of my suggestion that the late esteemed professors at Carlsruhe (Germany) deserve credit for giving to their students in lectures and experiments at once any new advances in applied sciences.

My sincere thanks for it. For instance: Prof. Eisenlohr gave in 1854, by experimental demonstrations, the "wave theory" of sound and light better than I saw it since sixty years. Prof. Redtenbacher was the first one to teach "construction" in mechanical engineering on a system based on theoretical plus practical investigations.

Thumb rule of millwrights to produce mechanical contrivances ended forever with Redtenbacher's "system" of construction. My late friend, Prof. Reuleaux of Berlin, the Sulzer brothers of Winterthur, Switzerland (my fellow student), Belgian, Austrian, and German engineers laid the foundation for future great achievements under Eisenlohr and Redtenbacher at Carlsruhe. I am close on 80 years, and felt during my long professional career the benefits of teachings by such able and esteemed men who understood to give lasting foundations in the minds of their students.

Little Rock, Ark. ROBERT KUNSTMAN, M.W.S.E.

The Fallacy of Eternal Youth

To the Editor of the SCIENTIFIC AMERICAN:

A quarter century has passed since Brown Sequard launched a goat's lymph theory of everlasting life. So it is with those who have moistened their lips by a new sensation, after the inconveniences, and pains and aches of age set in; then, these scientists look about for a "Fountain of Youth," or becoming reconciled to the inevitable, he seeks by a fair or foul means some sort of intercourse with the nether world.

There are topics beyond human understanding, and many theories must be taken upon faith. We cannot explain why and how we entered upon the units of this world we live in, and we cannot explain where and how we are leaving it, save by faith, and the belief in the teachings of those best qualified to advance satisfactory dogmas. Have any of these comprehended fathomless space? Our five senses carry to the brain a few mathematical facts of scientific research, yet we continue to seek, until we must eventually round up at a standstill. In a limited world, there is a limited investigation. The lower animals live their lives, guided by instinct. Man, only recently is beginning to know what the birds have known of the air since time immemorial. The study of air rivers, air eddies, calms, storms, electric, etc., is being worked out by aviators. Why not employ more instinct and less scientific investigation, where the seeming impossible is to be surmounted? The conscience of man is an instinct. The conscience rules the higher ego, the appetites the baser self. Those who have studied conscience, believe that that conscience lies are only made the happiest, which gives no stirrer that painful sensation is caused. Napoleon was strong, but observe the darkness of a Sahara, in the same way, what of gaining close to nature—is to be our share of the final issue and test?

SCIENTIFIC AMERICAN

It is plausible to prolong the life of a cell by bathing it in its life-giving pabula, or by supplying a new cell element at its molecular death. It is possible to preserve a building by substituting a brick, a stone, a door, or a window for the disintegrated unit, but! what an exhausting, troublesome method, when the old structure can so easily be demolished in its entirety, and a new and beautiful one reared in its place. Man's life is continued by his progeny, until it is ordained, that man can no longer inhabit this sphere of the universe. With each geological era, a new creature held sway, and then quietly passed into oblivion. Therefore, there is no logic in assuming that the creature, man, has arrived to stay.

To offer the public any such fallacy as indefinite existence, to disappoint an already hysterical "idle rich," is as wicked as to promise to a "deserving poor," immunity from tuberculosis, or for that matter, any rapacious disease decimating their ranks.

J. A. GUTHRIE.

Portsmouth, Va.

More Technical Writings by Untechnical Men

To the Editor of the SCIENTIFIC AMERICAN:

The letter from Mr. Charles S. Rindfoos in your July 11th issue on the technical writings of untechnical men inspires me to record a few recent slips of the newspaper writers in dealing with the automobile. Automobiles are fairly familiar articles, both on the streets and in the papers, yet observe this display of ignorance in one of the New York papers. The account has to do with a street accident, and the reporter concludes his remarks by writing: "The chauffeur opened his exhaust valves, and the cloud of steam which belched forth obscured the number plate." Either this car was a steamer with hand-operated exhaust valves (!) or the reporter didn't mean exactly what he said.

The *Sun* not long since told of a beginner who became confused and ran up on the sidewalk, injuring three people. The car would have done further damage, the *Sun* tells us, but for the presence of mind of the demonstrator sitting beside the beginner, who "pulled the clutch lever, bringing the car to a halt." Obviously a new type of control mechanism on this car, with hand-operated clutch having marked braking powers.

The following was printed in the *Mail* a week or two ago: "Several persons living nearby said they heard a loud report shortly after 8 o'clock, but all thought it a cylinder explosion on an automobile." Of course, the reporter meant that they all heard a muffler shot, but why an "explosion on an automobile."

The most perfect contribution to technical literature of all, however, has been reprinted in the English *Motor* from the Plymouth *Sports-Herald*, as follows: "Through a fly getting into the carbureter and turning the sparks in the wrong direction a large motorvan caught fire last evening. . . . All the bottom part of the car was damaged, and the wires and the magneto were burnt." The *Motor's sole* comment is, "What happened to the daring fly?"

ALBERT F. LOOMIS.

Huntington, N. Y.

Instinct or Reason?

To the Editor of the SCIENTIFIC AMERICAN:

In looking over some back numbers of the SCIENTIFIC AMERICAN I noticed in your correspondence column a letter regarding animal instinct. It reminded me of a performance to which I was witness at Winona Lake, Indiana, in 1900. Birds are made welcome there, so the woods are full of members of the feathery tribe.

One day I saw a pileated woodpecker, or flicker, working away in a very peculiar manner. He pecked or nibbled at something on the ground and then drew his beak down the lower border of his wing. Again he pecked, and drew the lower border of his other wing through his beak. He kept up this performance, alternating the nibbling and stroking of first one wing and then the other, for five or ten minutes at a time. I was very much puzzled, and on investigation found that he was working at an ant hill, and I was still more puzzled.

Later I saw purple grackles going through the same maneuvers, with ecstatic eagerness at an ant hill. And then one day the secret was revealed, as I watched one of the iridescent gentlemen with a piece of orange peeling. I was not more than fifteen feet away from him, and I could see perfectly what he was doing, *and he was not eating the orange peeling!* He was nibbling and squeezing it in his beak, and stroking his wing feathers. All he lacked was a mirror! It took him some time to prepare for the reception to which he had evidently been invited, and so I had a good opportunity to observe his toilet preparations.

The secret of the strange operations at the ant hill, of both blackbird and his speckled brother, the flicker, stood revealed. These birds used formic acid instead of oil of orange peeling.

I had never been a witness to such performances on the part of birds before, neither had I ever seen anything similar recorded, even though I have always been an interested reader of everything I could find of bird and animal life.

Perhaps some of your readers may have seen birds using perfumes. I wonder if the fashion started at Winona Lake, Indiana? (DR.) EMMA T MILLER.

San Antonio, Texas

The Case of the "Siberia's" Wireless Message

To the Editor of the SCIENTIFIC AMERICAN

Your correspondent, Mr Philip E Eddleman, in commenting upon the reported accident of the steamer "Siberia," has evidently failed to recognize the most probable cause for the confusion of the signals as given out in the press.

To date there has appeared no explanation of the reports on the part of the operators concerned, themselves, and it appears a little premature to so severely censure the men who were in charge of the radio equipment on these ships without having some knowledge of the facts of the case.

It is well known to those versed in the art of radiotelegraphy, that there are times when the accurate reception of messages is exceedingly difficult, and in some cases entirely impossible. The writer has been intimately associated with the radio service commercially and scientifically, for a period of ten years, and can recall numerous cases to support this statement, as can any operator. As an example, on one occasion when the cable connecting Mackinac Island with St Ignace was broken down, an important message regarding an escaping criminal was handled between the wireless station on the Island and the station at Sault Ste Marie. This message was not a long one, and ordinarily should have required no more than two minutes for transmission, but, owing to necessary repetitions and re-repetitions, something over two hours was required to get it through correctly. This was due to the severe atmospheric conditions, known as "static," that were prevalent at the time.

Aside from static, which is the most common cause for delays or mistakes in messages, there are numerous other things that may make the reception difficult, among which may be mentioned induction or leakage from power or lighting circuits, interference from other stations, or loud, nearby noises such as fog signals, band music, etc., any or all of which may be found on a ship or near a land station.

Another wholly different cause for errors can be charged to the sending operator. Some men who are considered good operators, both wire and wireless, have the habit of running certain letters together, making so-called "combinations." As an example, the writer knows of one experienced operator who invariably makes the letters W M E (.— — . .) as W G (.— — .). Such combinations are very apt to be wrongly interpreted, especially when they occur in code words, or in call letters with which the receiving operator is unfamiliar.

Now, returning to the case of the "Siberia," the call letters M B S repeated three times, followed by the letters of the calling ship repeated three times, in accordance with the international regulations, if sent by an operator who was accustomed to making "combinations," might easily be mistaken for the S O S distress signal by wrongly combining the different characters. The letters M B S, in Continental Morse, repeated three times, are as follows:

M B S M B S M B S

— . . . — . . . — . . . — . . . — . . . — . . . — . . . — . . . — . . .

Now if these letters are run together, without proper spacing between the dots and dashes of the letters and between the words, we obtain the following,

— . — . . . — . . . — . . . — . . . — . . . — . . . — . . . — . . .

and the characters enclosed in the parentheses are the exact formations used in the distress signal.

Immediately following this call, it is reported that the calling ship sent out her position, which is exactly the things that would first be sent out after a ship had sent out the S O S signal. It is not so strange, after all, how an operator, hearing the above and possibly nothing else, might notify his captain that a ship was in distress. If the operator had overheard the above and, being uncertain as to just what the signals meant, and not notified the captain, he might then be criticised.

M. E PACKMAN,
Department of Radio Telegraphy,
Dodge's Institute of Telegraphy.

Valparaiso, Ind.

A Meteorological Library in New York City.—The New York Public Library has just acquired the extensive collection of meteorological works formerly kept at the Central Park Observatory. These consist chiefly of the year-books and other periodical statistical publications of foreign meteorological services and observatories; a class of literature which is found in very few libraries in this country. The largest collection of such works is that in the library of the Weather Bureau, in Washington.

Air Pressure in the Subway

By Frederic Campbell, Sc.D.

ALL who ride in the New York city subways have experienced a strange discomfort in the ear at various times, not always the same, and most pronounced in passing into and through one of the tubes leading under the river. This is due to the compression of the atmosphere produced by the train's motion; and it is felt most in the tubes because they are more confined, there being insufficient outlet for the air's escape. It is said that in the tubes of the Pennsylvania Railroad, passengers manifest particular sensitiveness, as indicated by unusual effort at swallowing; to this they are prompted because of the Eustachian tube, connecting the throat with the inner ear; it is an effort to equalize the pressure on both sides of the eardrum.

The aneroid barometer, so sensitive that it will often move its needle when even carried from the first to the second story, is well fitted to record and measure the variations of air pressure on moving trains in subways; and the writer recently made the experiment with a Tycos instrument. It is easy to believe that, if he had stood at the very front of the train, with the door closed behind him, so that no air could escape through the car, he would have found the needle indicating greatly increased pressure, that is, showing a higher record, as if one had descended to lower levels, where the air is always more dense. And, if he had stood at the extreme rear of the train, with the door closed behind him, so that no air could sweep upon his instrument from the interior of the cars, a much lower record would have been read, as if one had ascended to some lofty hilltop, where the air strata are more rarefied. Directly in front of every swiftly moving train, particularly if confined in a tube of small caliber, the air is being forcibly packed into a condition of great density; while directly behind it, the recession of the train is leaving the air behind, causing a partial vacuum.

But, these facilities not being granted to passengers, experiments can only be carried on within the cars; these, being open at ventilators or windows, afford good opportunities, as one's sense of discomfort in the cars may well assure us. The experiments in going were made in the front car, and in returning in the rear car. The trip going was from Borough Hall, Brooklyn, over the Broadway line to its terminus at 242nd Street. The trip returning was from 177th Street of the Bronx line back to Borough Hall, Brooklyn. As the barometer was found to stand exactly the same at Borough Hall on the return as at the start, it is apparent that weather conditions had not materially changed. The following table shows the readings, as recorded in the inches of the mercurial barometer column; the first column should be read down, the second column should be read up; this arrangement enables one readily to make comparisons.

	Front of first car, Broadway line, going.	Rear of last car, Bronx line, returning.
Borough Hall	29.84	29.84
Entering tube	29 90	29 88
Highest tube pressure	30 05	29.90
Lowest tube pressure	.....	29.84
Bottom of tube	.	29.87
Bowling Green	29.90	29 88
Wall Street	29 87	...
Between Brooklyn Bridge and Fourteenth Street	29.84-29 89	....
Fourteenth Street	29 86	29.85
Between Fourteenth Street and Grand Central	29 84-29 87	.
Grand Central	29 84	29.83
Between Grand Central and Seventy-second Street	29.80-29 86	..
125th Street		29.85
Between 149th Street and 135th Street		29 82-29.87
Third Avenue and 149th Street (subway begins)		29.84
177th Street, elevated platform, open air		29.78
242nd Street, elevated platform, open-air	29.82	.....
242nd Street, street level, open air	29 84	..

From the above figures the reader may draw his own conclusions. Looking them over, however, it is manifest that, within the train, there is not the difference in pressure that the ear discomfort seems to indicate. The very highest figures here given are 30.05, and the lowest 29.78, a difference of only 0.27 of an inch on the mercury scale. Every subway traveler knows how quickly the ear discomfort is relieved, even while still closely confined in the tube. It is conceivable, however, that, with the swift rush of the train, barometers in different cars and even in different parts of the same car would read differently at the same instant; with the whirl of the atmosphere, there may easily be dense spots, and also rare spots or "pockets;" and the action of the aneroid barometer is not sufficiently prompt in its response to rapidly changing conditions.

Enough is shown, however, to support the theory that there is condensation at the front and rarefaction at the rear of a subway train, and that this is particularly marked in the close limits of the river tube. The highest pressure was shown in the front car going, while in the tube; and, in the rare car, returning in the same conditions, the instrument recorded 0.21 of an inch less pressure. From this it would seem that relief from ear discomfort might well be expected at the rear of the train, and that this relief may be expected in increasing degree as one selects his seat farther from the train front.

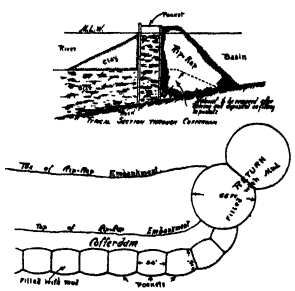
The high reading at bottom of tube is partly due to the low altitude; for there we are below sea level, and not a few feet beneath that of Borough Hall and the subway generally. Some other variations of reading are doubtless also due to variation of level rather than to differences of air pressure caused by the motion of the train. Where two or four tracks spread out across the subway, there is such opportunity for the air to escape that the barometer is not commonly affected; yet in the rush and whirl of swiftly passing trains it sometimes shows considerable uneasiness.

The Great Cofferdam for the Hudson River Piers

By Robert G. Skerrett

A VERY notable engineering task is under way on the Hudson River side of New York city preliminary to the building of the 1,050-foot docks for the biggest of ocean liners. The first of the new piers are to be located at the western ends of Forty-fourth and Forty-sixth streets, so as to facilitate the ease with which passengers may go to or from the center of the city with its hotels and railroad terminals.

As the Commissioner of Docks and Ferries, Mr. R. A. C. Smith has pardonably declared: "The construction



Cross-section and plan of the North River cofferdam.

of these piers involves unique engineering problems of very great interest. The site selected is located over a shelving rock ledge 20 feet below mean low water at the inshore end and from 44 to 50 feet below mean low water at a point approximately 220 feet from the present shore line. In order to remove this subaqueous rock it is necessary to uncover it by holding back the waters of the Hudson River by means of a temporary dam and by blasting out the stone when thus exposed. This method in the end will prove considerably cheaper than by the under-water blasting of the rock because it insures a more satisfactory consummation of the task. It is essential for the safety of the ships which are to use the piers that the rock be removed to a uniform depth, and that no jagged points be allowed to remain to menace the hulls of those vessels. This uniformity could be made certain of at a minimum of cost by working upon the rock only when uncovered. Besides, by dry excavation, it is possible to leave solid buttresses of rock to support the pier structures, and thus to provide smooth and uniform walls from the river bed upward."

To carry out the preliminary steps of this unusually large project, the engineers of the Department of Docks had to plan without any comparable precedent to guide them. True, the Federal authorities had done kindred work in the cases of the cofferdams at Black Rock in the Niagara River, and in uncovering the bed of Havana harbor preliminary to the raising of the ill-fated battleship "Maine"; but the task on the shores of the Hudson is a much more difficult one in certain particulars. The cofferdam when finished will have an approximate length of 800 feet, and with a depth of water of 38 feet, plus silt 30 feet deep overlying the ledge, the experts have had to provide against a combined hydrostatic pressure of a head of 68 feet. Therefore, even with the use of modern steel sheet piling, the stability of the bulkhead had to be secured by thorough support. Accordingly, there will be a bank of rip-rap on the inshore side having a width at the base of something like 70 feet, and rising to a point 6 feet above mean low water. The offshore side of the dam is being steadied by a clay embankment of suitable dimensions.

Between the dam and the shore there is now impounded a body of water amounting to quite 55,000,000 gallons, and the drainage of this will leave the structure to bear unaided the one-sided thrust of the Hudson. The area left dry will be 800 feet long with an average of 300 feet in width, and out of this pocket there will have to be excavated 76,500 cubic yards of solid rock to make the necessary channels for the slips for the first pier and a half. The half pier will be lengthened as occasion requires, and other piers will be developed later. But when the immediate project is completed, there will be a depth of available water at low tide of 44 feet, and room enough to accommodate three of the largest of the transatlantic liners.

The walls of the cofferdam are made up of Lackawanna steel sheet pilings having a width of a trifle over 12 inches between interlocks, and about 70 feet long. The pilings are driven so as to form a series of contiguous pockets with an average length of 24 feet and a breadth of 16 feet, the front and rear faces being slightly arched, and the connecting walls perpendicular to the flow of the stream. The pockets have been filled with the mud dug from the inner face of the cofferdam, preliminary to building the rip-rap up from the bed rock. The pile drivers have encountered a number of difficulties in the neighborhood of some of the old wooden piers, and at times it has taken 170 blows to get the piling home to rock bottom. Otherwise, the work has gone along in a satisfactory manner. The true test will come some months later when the basin is drained. By way of guarding against any show of weakness at that time, the face of the cofferdam has been provided with a couple of good-sized sluices, and it will be possible through them to reflood the area quickly. Again, these same sluices will facilitate letting the water in when the excavating is finished—a necessary advance operation before starting the demolition of the dam.

The cost of building the cofferdam and excavating the rock, as per contract, is to be $487,812.90. As high as $706,128.52 was bid, and the city's engineers figured the work could surely be done for $407,500. This was certainly coming pretty close to the possibilities of the contractor, and it is a very creditable performance on the part of the officials of the department concerned.

The Largest Fore-and-Aft Sailing Yacht

THE spirited picture on our front cover of this issue represents the largest fore-and-aft, three-masted sailing yacht in existence. It was designed by William Gardner, and is now nearing completion at Lawley's yard for Alexander S. Cochrane, the owner of the cup defending yacht "Vanitie."

Several notable three-masted fore-and-aft schooners have been built in this country during the past few years, which are thoroughly familiar to that portion of the public which takes a keen interest in yachting. The first of these was the "Atlantic," which, it will be remembered, won the transatlantic race for a cup offered by the German emperor. The second was the "Karina," designed by Theodore B. Wells for Robert E. Tod, and the latest and largest is the yacht which is herewith illustrated. The principal dimensions of these three vessels are as follows:

The Largest Fore-and-aft Schooner Yachts.

	Length on Deck	Waterline Length.	Beam.
"Atlantic"	184 ft	135 ft.	29 ft.
"Karina"	198 ft.	148 ft.	33 ft. 8½ in.
New Yacht	210 ft	150 ft.	33 ft.

The model of the new schooner is particularly handsome, and her form is so sweetly modeled that the expectations of her designer that she will realise from 17 to 18 knots in strong winds, and under the most favorable conditions bid fair to be fully realised. Although she is designed primarily for extended ocean cruising, her vast sail-spread will probably make her more than a match for her competitors when she is sailing under full racing canvas. Her length of 150 feet on the waterline and 210 feet on deck, and her beam of 33 feet and draft of 18 feet, to say nothing of her high freeboard, will render her a particularly commodious and able ocean-going yacht.

For calm weather and for maneuvering in making and leaving harbor, she is provided with a gasoline engine of 300 horse-power, which will be capable of driving her at 10 knots.

The new yacht will be furnished simply throughout in accordance with the taste of her owner, and she will have accommodations for 8 guests and a crew of 35 men. She carries a cold storage ice plant, and is electrically lighted throughout.

This view shows the cofferdam, with water pumped out and rock excavation in progress. The insert shows work as it will appear when completed.

BUILDING THE CITY'S NEW PIERS IN THE HUDSON RIVER.

Fog and Marine Disasters

By Dr. Félix Bertyn, Royal Observatory of Belgium

THE collision of the transatlantic liner "Empress of Ireland" and the steam collier "Storstad" off Rimouski, at the mouth of the St. Lawrence, during the night of May 28-29th, 1914, renders the subject of fog a matter of timely scientific interest, because it is now beyond doubt that the catastrophe, if not caused, was at least favored, by one of those ambulatory fogs to which the sailors of my country, by whom they are greatly dreaded, apply the expressive name of *bouchons de brume* ("fog-plugs").[1]

As the existence of this type of fog is generally unknown to the public, and even to scientific men—and consequently the occurrence of this erratic phenomenon at the time of the catastrophe passed almost without notice—it seems useful as well as opportune to devote a short note to the subject. We feel the more justified in doing this for the reason that we have previously made personal investigations on the subject (see *Ciel et Terre*, 1912, p. 67), and because the honor of having first called attention to the phenomenon in question belongs to two Belgian meteorologists, viz., Dr. Vanderlinden and the late Dr. Lancaster.

First of all—what is a *bouchon de brume*? It is a bank of low fog, or sometimes of smoke, having more or less sharply-defined boundaries, variable in size, and moving with the wind. Dutch sailors call it *mistbal*. Its appearance may be described as follows:

The atmosphere, being generally clear, there is suddenly seen to arise an immense fog-bank, whitish or dark in color, which gradually fills the whole horizon. As it approaches it assumes the aspect of a compact mass of vapor, rapidly advancing, and suddenly one *finds oneself* plunged in the midst of it. The phenomenon lasts fifteen to twenty minutes, and then, as the fog passes, the observer emerges as suddenly into the clear light of day. The phenomenon may occur on land as well as at sea, but it is more frequent over the water and at the mouths of rivers. It may occur either alone, or, more often, in connection with a general fog, of which it then constitutes a denser portion, with independent movement. It is more dangerous to the navigator than an ordinary more or less dense and more or less stationary fog because it *cuts off* his view suddenly, vessels which have sighted each other and exchanged signals are, in the twinkling of an eye, enveloped in an impenetrable veil, and, if fate so wills it, a collision is inevitable.

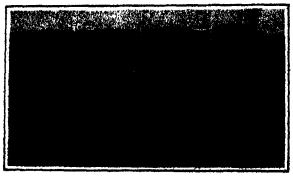
The mouth of the Scheldt was the theater of an accident of this kind December 20th, 1899, when the steamer "Luciana" ran into the "Maggie MacNair," which lay at anchor off Terneuzen. The latter vessel was seriously damaged and lost part of her cargo. The whole loss was estimated at 3,000,000 francs. A lawsuit resulted, and in the course of the arguments the existence of *bouchons de brume* came up for discussion, as the captain of the "Luciana" declared that, having been suddenly enveloped in one of these moving fogs, he did not have time to slacken the speed of his vessel before the collision occurred. In order to verify this statement the court ordered an inquiry into the subject of these fogs, the results of which confirmed the captain's statement and led to a compromise of the suit.

According to observations collected by the United States Hydrographic Office during the years 1901 to 1906, the region between Newfoundland and Nova Scotia has one day with fog in three during the month of May. A little farther east fog occurs one day in two. Everybody who has made the voyage to America has encountered these fogs, which sometimes give one the impression of traveling through cotton wool. A fog is merely a cloud resting on the earth's surface. Its origin is the same as that of the clouds, and it is of the same composition, differing only in its altitude. Like the clouds, it results from the condensation of atmospheric moisture. On land it is produced by the meeting, near the ground, of two atmospheric currents, one warm and one cold; the latter reacts on the former, robbing it of its heat and precipitating its water vapor in a liquid form. At sea fogs are engendered either by the action of marine currents, some warm and some cold, on the lower atmosphere, or by the influence of mild southerly winds blowing over a sea-surface, initially cold and cooled still further by icebergs and drifting ice.[2]

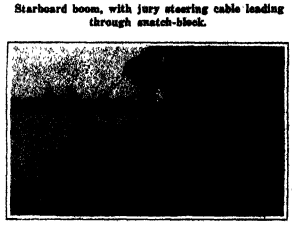
[The peculiar type of fog mentioned in this article was described at length by Dr. E. Vandeslindren, one of Dr. Bertyn's colleagues at the Royal Observatory of Belgium, in *Ciel et Terre* (Brussels), vol. 29, 1907, p. 159 ffg.—EDITOR.]

Bringing a Rudderless Ship Into Port

THE handiness of the sailorman is proverbial; and not infrequently emergencies occur on the high seas when this handiness has to be backed up by a considerable amount of intelligence, patience and courage. One of the most dangerous accidents that can happen to any ship is the loss, or complete disablement, of the rudder; and when the ship is of large size the difficulties of making repairs, or of rigging some kind of jury rudder, become multiplied. We were recently favored with a visit from Capt. Arthur N. McGray of the large freight steamer "Herman Frasch," which was built for carrying sulphur from the gulf to north Atlantic ports. The "Herman Frasch," on a recent trip from the gulf, had the misfortune, during heavy weather, to break her rudder, between the two upper pintles of the rudder post, as shown in one of our illustrations. The captain determined to make an effort to bring his ship



Starboard boom, with jury steering cable leading through snatch-block.



The fracture in the rudder of the freighter "Herman Frasch."

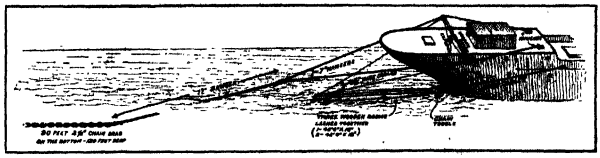


Diagram showing the jury rudders by which the "Herman Frasch" was brought into port.

into the nearest port by rigging a jury rudder. To this end he made fast 90 feet of 2½-inch chain to several hundred feet of 12-inch hawser, which, immediately abaft of the stern of the ship, was made fast to two lengths of 7-inch hawser. These hawsers were led, one to port and one to starboard, through snatch-blocks carried at the end of two derrick booms, which were lashed together at their inner ends, and made secure transversely on the after end of the poop deck. After passing through the snatch-blocks the 7-inch hawsers were led to a pair of winches. The depth of water at the place of the accident was about one hundred and twenty feet, with a sandy bottom.

Now it will be readily seen that by slacking off on the starboard 7-inch hawser and hauling in on the port hawser, the drag of the 90 feet of chain on the bottom would tend to swing the stern of the ship over to starboard, and, *vice versa*, slacking the port hawser and hauling on the starboard hawser would tend to swing the stern over to port.

The work of the drag was supplemented by another jury rudder, which consisted of three heavy wooden booms, the center one measuring 16 inches diameter by 45 feet long, and the two on the outside 12 inches diameter by 42 feet long. The three booms were strongly lashed together with wire cables. At [illegible] the booms there was attached a [illegible] from this two wire ropes led, one to [illegible] other to port, through hawse holes [illegible] from the after end of the booms, [illegible] cables led through snatch-blocks in the [illegible] transverse booms, above mentioned, to a [illegible] on the poop deck. The arrangement made it possible to [illegible] the outer or after end of the three booms over to port or starboard, and produced an additional steering effect on the ship.

By means of this gear, with the engines making from seven to eight knots, it was possible to make about three knots of the desired course; and ultimately Capt. McGray was able to bring the "Herman Frasch" into the nearest harbor for temporary repairs.

Radium and Cancer

THE radium treatment of cancer has aroused public discussion only equaled in sensationalism by the popular furore over the Friedmann treatment for tuberculosis. That this substance has some value in the treatment of cancer cannot be denied, but unfortunately the public has gotten an exaggerated impression of its effects, and radium has been hailed as the long-waited specific cure for malignant disease. In the belief that a statement of results would be useful, the American Society for the Control of Cancer recently asked Dr. H. H. Janeway of New York to prepare an article on this subject, which has just been published in the *Journal of the American Medical Association*, in which the following comments appear:

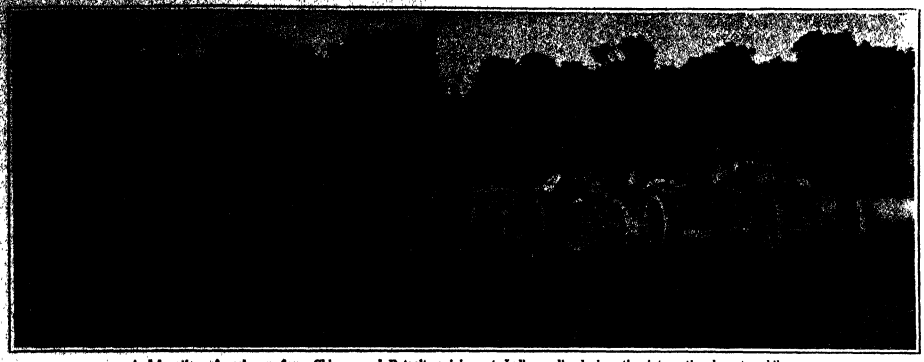
"Dr. Janeway discusses the results secured with radium at the four principal institutions in Europe where it has been employed under the most favorable conditions, viz., Paris, London, Vienna, and Heidelberg. The reports from each of these European institutes justify the statement that radium exerts a selective and destructive action on the majority of cancers, but that this action never reaches to the more distant extensions of the deeper and more serious forms of the disease. In fact, there is good ground for belief that unless the greatest care is used in the application of radium the more distant portions of the cancer will be stimulated to more active growth. All users of radium emphatically express the belief that no operable cancers except those of the skin should be treated by radium in preference to operation. The true position of radium at present is that it does not cure the disease unless the cancer is superficial or is of a variety particularly susceptible to its influence.

"For the last nine years, Dr. Wickham of Paris has treated 1,000 cancer patients at the Laboratoire Biologique du Radium, and has found that, while the influence of radium on all types of cancer is favorable, its effects do not extend to the limits of the disease in any but the most superficial varieties. The Radium Institute of London treated 467 cases during 1912. No patient has been classified as cured, since cancer is not regarded as cured until at least three years have elapsed without recurrence of the disease. Of 101 patients with the slow-growing, benign form of cancer of the skin, 81 were apparently cured, 41 were improved, and 12 did not improve. In cancer of the rest of the body, 15 cases were apparently cured, 156 improved, and 45 which did not improve. At the Vienna Radium Institute, of 34 patients treated for all forms of cancer, 6 died during the treatment, 11 were essentially improved, 6 were slightly improved, and 3 were made worse. At the Samaritan Hospital in Heidelberg improvement was produced in about half of the cases, but no patient was cured. The establishment of the fact that we have in radio-activity an agent which will even specifically affect cancer is of very great importance. No other agent has been discovered which in any degree approaches its effectiveness. But from the evidence at hand, it is clear that at present radium may only supplement, but not replace, surgical treatment."

Atomic Weights of Nebular Elements.—Nicholson has given a theory to explain the existence of certain rays in the spectra of the nebulae, those of hydrogen and helium particularly. Each atom is regarded as consisting of a nucleus having the quantities +1, +2e, +3e, etc., of positive electricity and surrounded by a ring of electrons, each having the quantity —e of negative electricity. For nebulium, the nucleus would have the quantity +4e of positive electricity and would be surrounded by 4 electrons. Considerations of this nature enable the existence of 9 simple elements to be predicted, (protogen, nebulium, protofluorin, archonium, etc).

[1] They are also known as *boîtes de brouillard* ("fog-balls"). —EDITOR.

[2] More definite explanations will be found in works on meteorology. Some particularly lucid statements on the subject are given in W. N. Shaw's "Forecasting Weather" (London, 1911).—EDITOR.



A delegation of cyclecars from Chicago and Detroit arriving at Indianapolis during the international automobile races.

Will the Cyclecar Come Into Its Own?

Possibilities and Limitations of the Light Vehicle in This Country

By John S. Harwhite

TOO many, the cyclecar is the unwelcome latest addition to the flourishing self-propelled-vehicle family; it is deemed unnecessary and is considered to overlap the fields so well filled by the small motorcar and the motorcycle with sidecar attached. The narrow tread is cited as being eminently unfitted for our average country roads, and the short wheelbase and light weight is thought to render riding comfortable only on the veriest boulevard. But are these beliefs warranted? Is the cyclecar movement doomed to a sporadic inception and a rapid death? Will the low-priced automobile and the constantly bettered design of the motorcycle and sidecar meet to fill the field now occupied by the cyclecar? The answer to these questions cannot be found in any previous motor vehicle building experience; the cyclecar proposition is a new one, and even England, the mother of the movement, does not furnish the solution, for in that country conditions are so totally different that they offer no comparison; our average roads are poorer, our automobile-owning class is different, and the high tax on motorcars above a certain weight that really started the light-car agitation in England, is lacking here.

In this country, it is much a matter of psychology. With its million and a quarter automobiles and several hundred thousand motorcycles, it naturally seems as though almost everyone could afford to own a self-propelled vehicle of some kind. But every American is, at heart, an aristocrat; if his neighbor owns a $3,000 automobile, he too wants a "real automobile," even though he is able to afford one costing only one eighth of that amount, and in the minds of many, an automobile *must* run on four wheels. It has been the experience of the writer that the motorcycle with sidecar offers one of the most comfortable and economical means of transportation for two persons yet perfected, but "the motorcycle is *not* an automobile." It is also difficult to convince those who have never had experience with the combination that the occupant of the saddle is comfortably insulated and is insulated from the sudden and jars that such persons firmly believe are the accompaniment of motorcycling.

In view of these desires and beliefs on the part of a large portion of the American people, it would seem that there is a splendid field for the production of a reliable, four-wheeled, self-propelled vehicle; only automobile-owners who have experienced their discomforts of building this type of vehicle would seem to share this opinion, at least, but the fact remains that actual *proofs* of the feasibility of the cyclecar, based on the performance of commercial quantities in the hands of a large number of users, are lacking, and, therefore, a prediction as to the success or failure of the movement can only be based on what the cyclecar is, and what it will do. Astonishing test runs of the little vehicles through snow and mud that would daunt many a larger car have been published from time to time, but these are special demonstrations participated in by experts, and it is the day-in-and-day-out *practicability* of the vehicles that will count with ninety-nine out of every hundred would-be purchasers.



Note the several distinctive cyclecar features—the two-cylinder air-cooled motor, the tandem seats, and the cantilever springs.



The light cyclecar is essentially a vehicle that appeals to women, because of its simplicity and ease of operation.



As long as water can be kept out of the carbureter, the cyclecar with armored magneto can ford any stream.

For this side of the question, we must look to the design of the average cyclecar and endeavor to determine the end sought to be attained. Primarily, the cyclecar must be of low initial cost and light in weight. The actual price, size, and weight limits that distinguish the cyclecar from its "automobile" cousins have not as yet been generally accepted by all manufacturers, but it would seem that these figures should be less than those relating to the smallest and cheapest *bona fide* automobile on the market. The average of what is known as the cyclecar in this country will weigh from 600 to 900 pounds, and will cost from $350 to $500. So far as length of wheelbase and tread are concerned, we have rather indefinite figures, but the former seems to run from 90 to 100 inches. A much-mooted question among manufacturers is whether a real cyclecar can be built with the standard tread of 56 inches, but inasmuch as one of the distinguishing characteristics of the original cyclecars lies in their narrow tread, it would seem that all those possessing the standard width between wheels should properly be placed in the light-car class. It has been well pointed out by an enthusiastic cyclecar exponent that the true vehicle of this type should be a "minimum" car, minimum price, minimum weight, minimum complication of construction, and, as a result of these features, minimum cost of upkeep. It may be pointed out that the price of the cheapest of the cyclecars is not more than a hundred dollars less than the cost of one or two well-known makes of automobiles, and that some are priced at $25 more. But while the production of cyclecars in increasing quantities may serve to lower the initial cost, as has been the case with the automobile and the motorcycle, it must

(Concluded on page 88.)

The Heavens in August

The Solar Eclipse and the Theory of Relativity—Another Comet Found

By Henry Norris Russell, Ph.D.

THE principal event of the present month, from an astronomical standpoint, will undoubtedly be the total solar eclipse which occurs on the 21st. On this day an eclipse of some sort will be visible throughout all Europe, in northern Africa, western Asia, and the northeastern part of North America. The narrow track of the dark shadow, or umbra, of the Moon, which nowhere exceeds 100 miles in breadth, begins off the Arctic coast of Canada, where the Sun will be eclipsed as it rises. Few human eyes will see the eclipse from the first two thousand miles of its track, which crosses the Arctic archipelago and the snowy wastes of northern Greenland. Then, turning somewhat to the southward, the shadow traverses the northern Atlantic and reaches the Scandinavian Peninsula, which it crosses nearly at right angles, near the middle of its length. Passing next over the Baltic, it reaches Russia, across which it sweeps from Riga to the Crimea, passing over the city of Kieff on its way. Half an hour after it has left the Baltic, the shadow will be in the Black Sea; then it departs into the eastern regions of Asia Minor, crosses Persia diagonally, and leaves the earth at the western limits of India.

The most favorable stations for scientific observation will be in Russia, where the duration of totality is a maximum (2 minutes and 14 seconds), the Sun high, and the chances of clear weather relatively good. A number of expeditions from other countries, in addition to the well equipped Russian parties, will establish themselves at various points along this part of the track. The only American party is that from the Lick Observatory, under the able direction of Prof. Campbell, whose station will be not far from Kieff.

The usual observations of the spectrum of the Sun's outer atmosphere, and of the *corona* will be made, and, if only the weather is good, the powerful instruments employed should yield very valuable results. Of the investigations which have not yet been conducted, perhaps the most interesting is the photography of the region around the eclipsed Sun, with instruments of such a sort as to permit of the exact measurement of the apparent positions of the stars which may be detected upon the plates. There is no longer any hope that any planet, smaller and near the Sun than Mercury, may be discovered on these photographs; the careful search made at previous eclipses, notably by parties from the Lick Observatory, has practically settled this. But, according to certain phases of the new theory of relativity which is exciting so much discussion among physicists—and which those without physical training find so difficult to understand—according to some of the exponents of this theory, a beam of light, passing close to a great gravitative mass like the Sun, should be deviated a little from its rectilinear course—to the same extent, indeed, that a projectile moving with the velocity of light would be deflected by the Sun's attraction.

The theoretical deviation, even for a ray of light grazing the Sun, should be very small, only about one *second of arc*. As a star's light would be bent on toward the Sun, the stars, apparently near the Sun, but really far behind it, would, as can easily be seen, appear to be displaced on the sky outward from the Sun's center, by amounts diminishing with increasing angular distance from the Sun.

If this effect actually exists, it should be capable of detection upon plates taken with suitable instruments. It is not yet at all certain whether the theory which predicts such a phenomenon is really correct; but these astronomical observations should be capable of deciding the question—if not at the present opportunity, then at some future and more favorable one.

For observers in the United States, this eclipse will be a small, partial one, on the northern limb of the Sun, occurring in the early morning. From points east of a line drawn from Rochester, N. Y., to Washington, the whole eclipse is visible shortly after sunrise, at about 6 A. M. For points farther west, about as far as Chicago and Minneapolis, the Sun rises eclipsed.

Another comet has been added to the list of the year's discoveries, found this time by the Russian Neujmin (who was the first to detect the remarkable faint comet of last year) on June 29th. The present comet is also faint, being visible only in a large telescope. The elements of its orbit show that it is already far past perihelion and has been receding from the Sun since March 4th. At that time it was a little over 100 million miles from the Sun, but now it is about 200 million miles from him and nearly 100 million from us, and is still receding and steadily growing fainter. Its computed positions are, for Greenwich, midnight July 6th, 17 hours, 58 minutes, 6 seconds — 11 degrees 19 minutes; July 18th, 17 hours, 40 minutes, 24 seconds — 9 degrees 20 minutes, which puts it not far from the star γ Ophiuchus, shown on our map. Beyond this date its motion will be at first northwestward, and then curve, so as to be almost directly northward, and will diminish to a small fraction of a degree per day; but the comet will be so faint by the time that this is published that it will be observable only with powerful instruments.

Delavan's comet is now in the morning sky, and is steadily growing brighter. It was seen just before dawn on June 30th by Mr. J. R. Hooper, an amateur astronomer of Baltimore, and must have been fairly bright to be seen at all so near the Sun.

Two careful computations of the orbit, which have recently appeared, agree in showing that the comet's path is very nearly parabolic, its period being probably at least ten thousand years, and very likely much longer.

On August 1st the comet will be in 6 hours 5 minutes right ascension, and 39 degrees north declination, about 3 degrees northeast of θ Auriga, near which it will pass on July 27th. On the 15th its position will be in 6 hours 55 minutes + 44 degrees, and it will continue to move, at a steadily increasing rate, almost along a line drawn from θ Auriga to ι and κ Ursæ Majoris, near which latter stars it will pass early in September.

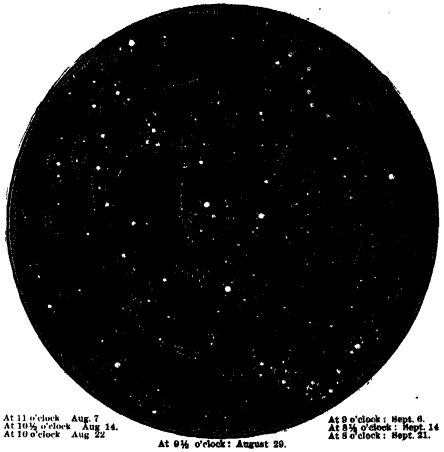
All through the month it rises at midnight or earlier, and gets well clear of the horizon some time before dawn. The best time to observe it will be about 3 A. M. its predicted brightness, making no allowance for the increase of intrinsic luminosity which comets usually show near perihelion, is about equal to that of a star of the sixth magnitude. It should, therefore, be easily visible with a field-glass, and probably with the naked eye. How much tail it will have cannot yet be predicted. The presence of moonlight will seriously interfere with seeing the comet from about the 3rd until the 20th, but it should be very easy to find before and after these dates.

The Heavens.

Right over head (and shown in the center of our map) are the splendid constellations Cygnus and Lyra. Just south of them are the small groups of Sagitta and Delphinus, and then the larger one of Aquila.

Below this, in the southwest, is a magnificent region of the Milky Way, extending down to the "Milk Dipper" of Sagittarius, and to Scorpio, which is now setting. To the left, almost due south, we see the twin stars of Capricornus, the upper one of which is a pretty double to the naked eye, and the lower one to a field-glass.

Fomalhaut, the one bright star of the Southern Fish, has risen in the southeast, and a part of Cetus may be seen farther to the left. Above these is the very barren region of Aquarius, and the few but conspicuous stars of Pegasus. Andromeda and Aries are north of east, and Perseus and Cassiopeia farther on, due northeast. Cepheus, Draco, and Ursa Minor occupy the upper north, above the Pole, and Ursa Major is well down in the northwest. Hercules, Corona, and Boötes are in the west, and the tangled forms of Ophiuchus and Serpens fill the southwestern sky.



NIGHT SKY: AUGUST AND SEPTEMBER.

The Planets.

Mercury is a morning star almost throughout the month, but is only well visible at its beginning. He is apparently farthest from the Sun on the 8th, being 19 degrees 14 minutes west of him, and on that date he rises about 3:40 A. M., and can easily be seen before dawn.

Venus is evening star in Virgo, and remains visible until between 8 and 9 P. M. She is very brilliant, and far outshines anything else in the western sky. During the month she takes part in two interesting conjunctions. The first is with Mars, on the evening of the 5th, when the two planets are but 10 minutes apart—only one third of the Moon's apparent diameter—and can hardly be separated by the unaided eye. The second close approach is to the bright star Spica, which will be within a degree of the planet on the evening of the 30th. Both conjunctions will be well worth looking at, particularly the first.

Mars, as appears from what has just been said, is also an evening star. Except at the beginning of the month, he sets earlier than Venus, and is not conspicuous.

Jupiter is in Capricornus, and comes to opposition on the 10th. Though still 17 degrees south of the celestial equator, he is better placed for observation than he has been for two or three years past, and is a beautiful telescopic object.

Saturn is a morning star in Gemini, rising about 1 A. M. in the middle of the month. Uranus is in Capricornus, and comes into opposition on the 2nd. His position on the 1st is right ascension, 20 hours, 49 minutes, 18 seconds; declination — 18 degrees 29 minutes; and, on the 29th, 20 hours, 44 minutes, 58 seconds — 18 degrees 46 minutes. With the aid of a good star map he may be identified, appearing as a star of the sixth magnitude.

Neptune is just past conjunction with the Sun, and is practically invisible.

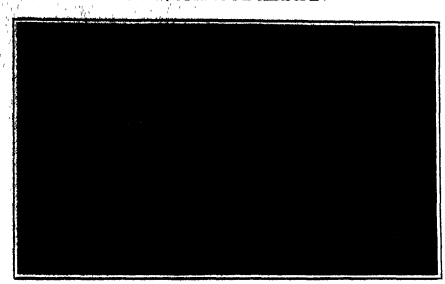
The Moon is full on the 5th, at 8 P. M.; in her last quarter at the same hour on the 13th; new at 7 A. M. on the 21st, and in her first quarter at midnight on the 27th. She is nearest us on the 24th and farthest away on the 12th. She is in conjunction with Uranus on the 8th, Jupiter (rather closely) on the 6th, Saturn on the 16th, Neptune on the 19th, Mercury on the 20th, and with Venus and Mars on the 24th.

Avon, N. Y., July 21, 1914.

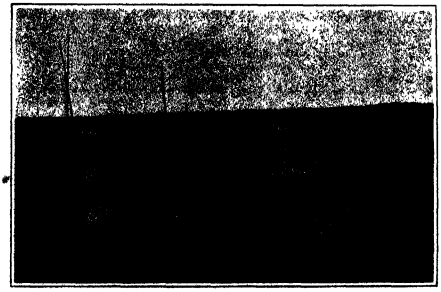
Soya Bean Products form a subject of steadily increasing prominence in the technical journals of the Old World. Soya milk is now produced by several factories in Europe and the Far East. A factory is about to be established in Liverpool which it will be manufactured on a large scale according to the process of Dr. Fritz Gösel of Essen, Germany. It will be retailed in England at four cents a quart. The flour made from soya beans has recently found new uses in medical circles. Mixed with sweetened condensed milk it is recommended as an infant food when safe fresh milk is not obtainable. It is also valuable in the treatment of diabetes on account of the absence of starch.

Japanese Irrigation Pumps

The accompanying illustrations should give the hint to enterprising pump manufacturers that their wares are needed in Japan. The photographs show the primitive methods still employed in that country for supplying water to the rice fields. The apparatus used consists essentially of an undershot millwheel in which power is applied to the wheel to raise the water. In other words the operation of the wheel is reversed. A glance at the photographs will show that the construction of the wheel is very ingenious, particularly in the case of the wheel operated by foot power. Each paddle is carried by a pair of spokes braced by a pair of struts that lie in the direction of the thrust of the operator's weight. At the end of each paddle-wheel is a short treadle piece on which the operator walks. Of course the advantage of this waterwheel lies in the fact that it can be made very cheaply, and the operating cost is low because labor is very cheap in the Orient. Nevertheless, it should be a simple matter to demonstrate that a power-driven pump is far more economical in the end, than these wheels belonging to the times of ancient Egypt.



Irrigation with a handwheel in Japan.



Flooding the rice fields with a treadmill.

The Clock in the Motor Car Wreck

A FOUR-PASSENGER motor car was crossing a railroad track near Omaha one night this summer when it was struck by a passenger train. What happened to the car is shown in the accompanying photograph. It was so completely shattered that every piece of the motor, body, etc., was reduced to junk. The remains of the car were scattered along the tracks for a distance of 500 feet.

As in most accidents, a freak condition was found among the ruins the next morning. The automobile was fitted with a clock speedometer combination. The automobile was struck at about midnight, and yet when the photograph was taken the next morning at 9:40 the clock was still running, and had not lost a minute.



On the morning after, the clock was still running.

A Steeple Jack's Climbing Irons

IT is quite a trick of boys to make wire climbers with which they can climb a smooth telegraph pole. Heavy telegraph wire is used and formed into a double ring, the larger ring encircling the pole, while the smaller one serves as a stirrup. The weight of the boy when carried by the stirrup causes the ring to bite into the pole and cling fast, but as soon as the stirrup is raised by the foot it releases the ring, permitting it to be slid up the pole to take a fresh hold farther up. With a device of this sort on each foot, it is a simple matter to climb the pole.

A very similar scheme has recently been utilized by a steeplejack who frequently finds it necessary to climb a flagpole for the purpose of painting it, or adjusting the pulleys at the top without marring the pole. He uses a wire ring fitted loosely around the pole, but carrying a pair of angle irons that are connected at the outer end to a block which serves as a footrest. It is very evident that the pressure on the foot rest causes the angle iron to take a hitch in the wire ring, making it bite into the pole. One of our photographs shows him at the top of a tall flagpole, trusting implicitly to his climbing irons while he plies the paint brush

Medals Awarded Annually by the American Museum of Safety

THE SCIENTIFIC AMERICAN gold medal, for the most efficient safety device invented within a certain number of years and exhibited at the museum

The Travelers' Insurance Company's gold medal, to the American employer who has achieved greatly in protecting the lives and limbs of workmen

The Louis Livingston Seaman medal, founded by Dr Louis Livingston Seaman, for progress and achievement in the promotion of hygiene and the mitigation of occupational disease

The Rathenau gold medal of the Allgemeine Elektricitäts Gesellschaft of Berlin, for the best device or process in the electrical industry, safeguarding life and health.

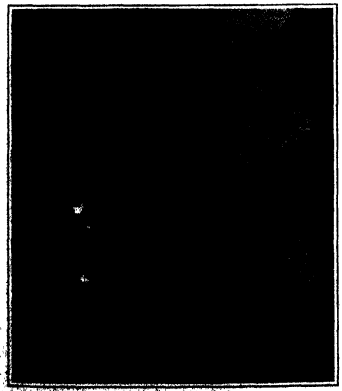
The E H Harriman memorial gold medal, founded by Mrs Harriman, to be awarded to the American steam railway making the best record in accident prevention and industrial hygiene affecting the public and its own personnel during each current year.

Kite Signaling of the French Navy

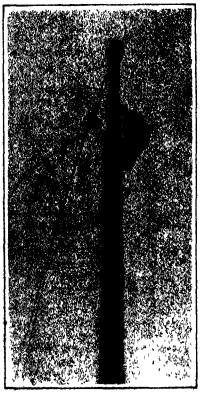
NOVEL ways of signaling were tried out recently during the naval manœuvers in the Mediterranean by men aboard the French warships. It was generally conceded that the tests with box kites were most efficient. The results proved that the box kites, being light, can be hoisted even when there is but a slight breeze, and their size makes them easily discernible from great distances

The signal system used was similar to that of the flag system. Various combinations of kite grouping were used While this system of signaling is not quite so fast as signaling by means of flags, it is more definite, it is claimed, and can be seen for miles around

The success of the experiment has led to a recommendation to the French government that the system be introduced generally in the navy of France.



A steeple jack's climbing irons.



The human fly at work.



Kite signaling from a French battleship.

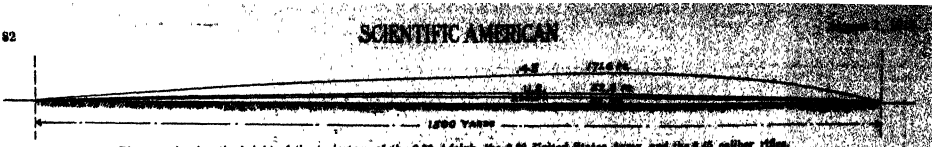


Diagram showing the height of the trajectory of the 0.30 Adolph, the 0.30 United States Army, and the 0.45 caliber rifles.

Super-high Velocity Cartridges and Three-barrel Guns

By Frank C. Perkins

THE accompanying illustration shows the most modern super-high velocity cartridges. Until recently the term high velocity was applied to cartridges which developed a velocity of about 2,200 foot-seconds. Through the use of Spitzer bullets and improved powders it has been possible to raise the velocity up to 2,700 feet in the United States Army 0.30 cartridges (No. 4), and 2,800 feet in the 0.22 Savage (No. 6).

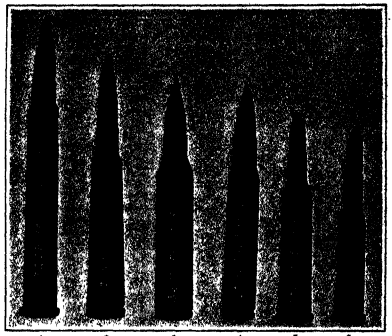
The next step forward was indicated by the appearance of the Ross 280 cartridge (No. 2), which developed a velocity of 3,050 feet, with a 145-grain bullet. The shell is much larger than the shells of the Mauser type, and requires a longer magazine. The cartridges which have the highest velocity, combined with greatest energy, are to-day the 0.30 Adolph express and the 0.30 Newton express. The latter, indicated by No. 1 in the photo, is designed for use in single-shot rifles, double-barreled rifles, three- and four-barreled combination guns, where the thickness of the barrel has to be limited.

The 0.30 Adolph express (No. 3) shown in the photograph is a cartridge of the same ballistic properties as the 0.30 Newton express, but is rimless, and designed for use in the common Mauser actions. The velocity of this cartridge with a 150-grain Spitzer bullet is 3,208 foot-seconds, with a 170-grain bullet 3,000 foot-seconds. The energy of this cartridge is 3,445 foot-pounds. In order to understand fully the progress in this matter one has to look back to the time of black powder cartridges, when the same energy was obtained by a cartridge of 577 calibers, with 160 grains powder and a bullet of 520 grains weight. It was necessary to build rifles for the latter cartridge very heavy, to withstand the severe recoil, and such a gun weighed hardly less than 14 pounds. A great advantage of these modern cartridges is the extremely low trajectory, which greatly increases the danger zone. The trajectory at 500 yards of the 0.30 Adolph is only 1.37 feet, but for the 0.45 caliber it is 9.5 feet. For the United States 0.30 Army rifle it is slightly over 2 feet at the same range. At 1,500 yards the 0.45 rises 171.6 feet, the United States rifle 52.8 feet, and the Adolph 35.6 feet. A 0.30 Adolph express has fired a full-jacketed bullet, through about seven feet of pine. A three-barrel gun has been designed for the 0.30 Newton express cartridge, consisting of two shotgun barrels of 12 gage, with a rifle barrel below, the weight of which is 7¼ pounds without scope. The accompanying ballistic table shows the difference between modern and old-time cartridges.

Range	Bullet	22 Short H P Rev. C.	Ross 280 No. 2	30 U. S. G. Mk. 4 No. 4	30 Cal. 150 gr. Adolph No. 3	45-70-500
Muzzle	Velocity, foot seconds.	2,800	3,050	2,700	3,208	1,201
	Energy, foot pounds	1,190	3,002	2,445	3,445	1,602
500 Yd.	Velocity, foot seconds	1,341	2,076	1,968	2,049	882
	Energy, foot pounds	272	1,302	932	1,395	770
	Trajectory, feet	2 346	1 43	2.04	1 37	9 49
	Time Flight, seconds	784	.597	709	.586	1 54
1,500 Yd	Velocity, foot seconds.	641	998	853	928	484
	Energy, foot pounds	62	319	244	285	310
	Trajectory, feet	71 8	32 0	52 8	35 6	171.6
	Time Flight, seconds	4 26	2.83	3 45	2 98	6.55

Forest Officers in Washington and Oregon plan to discontinue the use of barbed wire on their forests.

This will affect their own pastures and public drift fences. They say barbed wire has no advantage over smooth wire, that it injures stock, and that it is more likely to be borne down by soft snow. Stockmen on the Ochoco forest, in Oregon, recently constructed drift fences of smooth wire, though with some misgivings; now they say they will never use barbed wire again.



A group of super-high velocity cartridges.

Desiccated and Frozen Eggs

By Otto Mauser

THE young industry of desiccating eggs and preserving them by freezing the egg contents in bulk, seems destined to have a great future and to revolutionize the egg industry of this country. The desiccated product not only furnishes an excellent and highly nutritious substitute for fresh eggs, in compact form, to campers, explorers, sailors, and soldiers, but there is an increasing demand for it for general culinary purposes, and wherever eggs are used in large quantities, as for instance, in bakeries and restaurants. The product appears in the market chiefly in the form of golden yellow flakes, which are made ready for use by simply dissolving them in water.

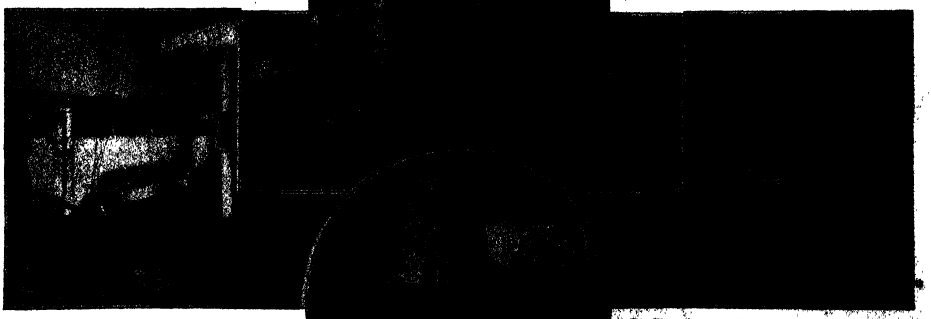
A visit to a factory where desiccated and frozen eggs are prepared gives one a fair impression of the magnitude of the egg industry in general.

As the eggs arrive in the familiar egg crates from the dealers and small commission merchants they are immediately placed into a large refrigerated room, where they are quickly cooled to a point just above freezing to stop the growth of germs and to prevent decay during subsequent handling. The chilled eggs are then transferred, as soon as possible, to the candling room.

Here we see long rows of small darkened booths, from the background of which two circular spots of light of about the size of a half dollar stare at us. This is technically known as the candle. It usually consists of a bright electric light, which is inclosed in a metal or wooden case to keep in all the light, except what escapes through the two circular holes. The candler, usually a girl, juggles the eggs with great dexterity and rapidity before the light-holes so that the strong light shines through the eggs. This reveals all defects and abnormalities in the egg. A fresh egg presents a uniform yellowish hue, with a small air space at the blunt pole of somewhat lighter color. As the egg undergoes decomposition, through the activity of micro-organisms, it loses its transparency and uniformity of color and appears cloudy, often showing dark spots. Since there are numerous minute pores in the shell, evaporation goes on continually, producing a shrinking of the egg contents, with a consequent increase of the air-space. The size of the air-space, therefore, serves as an indicator of the age of the egg. During the hot summer months many eggs show what the candler calls a blood-ring, formed by the primitive blood-vessels of the developing chick. As the candler candles the eggs, the candler distributes them over various boxes representing as many different grades. All eggs that will not stand further shipment and that are unfit for the expensive cold storage, go to the breaking-room. Here the candler all cracked, dirty, watery eggs, and others that are perfectly fit for consumption, but which would be likely to spoil or break during further shipment or withstand cold storage. In the breaking-room cleanliness is even before economy. Thus

(Concluded on page 84.)

Breaking the eggs and separating white from yolk.



Where the air current is dried, filtered, and heated.

Where the egg is delivered upon the drying belts.

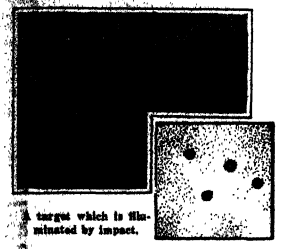
Candling the eggs for defects and abnormalities.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

A Target Which is Illuminated by Impact

A PATENT was recently granted to William H. Buell of New Haven, Conn., for a novel kind of target. When a bullet at the target, and a portion about the point of impact becomes momentarily illuminated.



A target which is illuminated by impact.

Thus the marksman can know at once whether or not he has made a bull's eye.

The outer or impact surface of the target is prepared with a thin superficial coating of any one of a great variety of flashlight compositions such as a composition of chlorate of potash, magnesium and collodion applied by an ordinary brush. When a bullet hits such a prepared surface, the composition is immediately ignited at the point of impact and flashes into light. The character of the composition is such that the ignition does not spread over the entire surface, but confines itself closely to a portion of the surface actually hit by the bullet.

Planting Hair on Bald Heads

MANY unsuccessful attempts have been made to cure baldness by the implantation of hair; but a hair planting method employed by Dr. Szekely in Buda-Pesth is claimed to be a practical one, by Prof. Pravaz. The method is described as follows in *Die Umschau:*

"The end of a gold wire 1/500 inch in diameter, is bent to form a loop, barely visible to the naked eye, which is threaded with a woman's hair of the desired color, soft, fine, and from 8 to 12 inches long (Fig. 1). The wire is introduced into a short, fine Pravaz hypodermic needle (Fig. 2) and drawn forward until the threaded loop is just inside the point of the needle. The wire is then bent back and cut off to a length of 1/12 to 1/8 inch, forming a tiny hook (Fig. 3). Several hundred needles are prepared in this way, and are thoroughly sterilized before they are used.

The part of the scalp where it is to be planted is sterilized and made insensitive by appropriate [illegible] Then the needle, charged with [illegible] is introduced into the skin, but is then inclined, thrust forward under the skin and turned through an angle of 180 degrees. It is then carefully withdrawn, leaving the doubled hair anchored by the hook in the subcutaneous tissue. In this way pairs of hairs are implanted at distances of 1/25 inch, so that about 625 pairs, or 1,250 single hairs, are planted in a square inch. In a single treatment, occupying 30 to 45 minutes, 400 or 500 hairs can be planted.

"The slight inflammation which develops around the sterilized gold wire quickly subsides, and is succeeded by a scar, which attaches the hair still more firmly to the scalp. The puncture made by the needle is soon covered by new skin. The soreness caused by the inflammation is trifling, and is scarcely appreciable after

Fig. 1.—The loop of gold wire threaded with a hair.



Fig. 2.—The threaded wire is drawn through a Pravaz hypodermic needle.



Fig. 3.—The needle with the wire hook and hair ready for use.

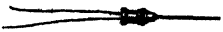


Fig. 4.—Complete needle with hair.

10 or 12 days. I have not observed, in a single case, any ulceration, necrosis, or even severe inflammation. In every case the hair, if in perfect condition at the time of planting, remained firmly attached and showed no tendency to break off at the wire or elsewhere. The

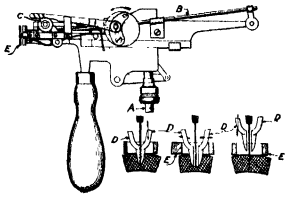


Fig. 5.—Instrument that plants hair at the rate of sixty per minute.

wire, in all probability, becomes imbedded in newly formed connective tissue, for it causes no pain when the scalp is massaged.

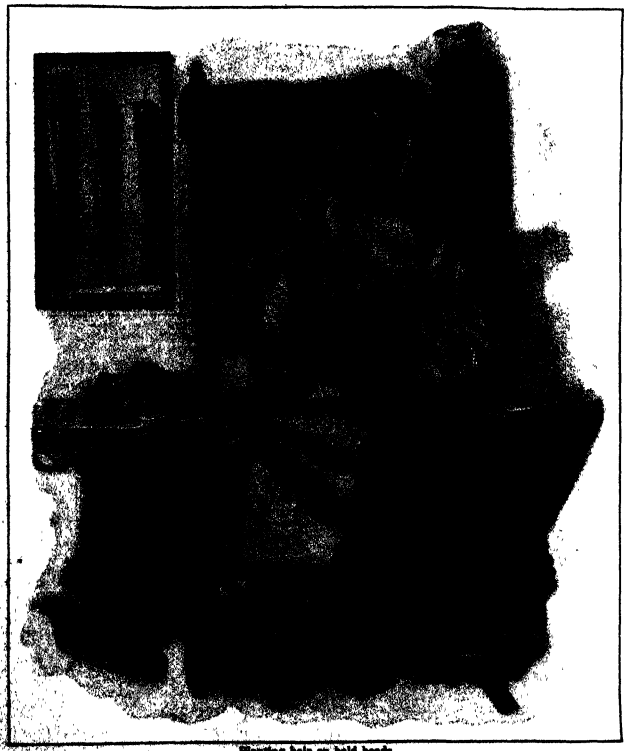
"Hitherto, operations have been confined to the scalp. The number of hairs implanted ranged from 10,000 to 50,000. From 15,000 to 20,000 hairs suffice to cover completely a bald crown, surrounded by a fringe of natural hair, but as many as 50,000 may be required for an entirely bald head. Even in this case little more than 15 grains of gold is consumed.

"The implanted hair presents so natural an appearance that it deceives the ordinary observer, and betrays its character, even to the specialist, only by the fact that the hairs are *associated in pairs.* It can be brushed, combed and washed, and it should be oiled occasionally in order to preserve its softness and gloss. In short, this method of planting hair is hygienic, cosmetic and practical. The permanence of the result is indicated by the fact that in one case, where the whole crown of the head was thus covered, the implanted hair has remained in perfect condition for seven years."

In this connection it may be interesting to note the hair-planting system developed by one of our countrymen—Dr Jacob H. Parsegian—residing in San Francisco. Instead of looping the hair under the skin, he punctures the scalp and plants the hair in the puncture. A special instrument is used, capable of operating at a rate of sixty insertions per minute, if desired. Hairs of considerable length are fed through the instrument, planted, and cut off automatically to a gage adjustable as desired.

A sketch of the instrument is shown in Fig. 5, also three magnified views of the split needle, illustrating how

(Concluded on page 91.)



Planting hair on bald heads.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the Inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

GARMENT BAG.—D B. FALK, German Bank Building, Savannah, Ga. The present invention is an improvement in garment bags, and consists in the provision of a top-closing flap which is in one piece and provided with means for receiving the head and shank of a garment hanger there through, in such manner that when the flap is closed with the garment and garment hanger in proper position, the garment will be protected from dust, either temporarily or from season to season, as may be desired

Electrical Devices.

ELECTRIC FAN TRACTOR.—M. P. SARFATY, 518 W. 143rd St., New York, N. Y. This invention conveys a fan so as to move the air in an apartment in layers or stratas, by imparting parallel impulses thereto; provides an automatic mechanism for moving a fan to operate in an ascertained plane and constant direction, provides automatic means for reversing the direction of travel of said fan at the terminals of its operating zone, and provides a tractor for supporting and moving said fan in the manner mentioned

BURGLAR ALARM.—W. E. CLARK, Saranac Lake, N. Y Address A. W. Botsford, same place. The invention relates more particularly to electrical alarms for preventing safe breaking in post offices, stores, and like places. It provides an entirely separate and distinct circuit between each of the circuit closers and the bell, and in practice the wires of these circuits are preferably run through different parts of the building, so that even though a safe-breaker discovers and cuts certain of the wires, the remaining circuits remain operative.

CIRCUIT CLOSER.—A. L. DAVIS, Clinton, S. C. The object of this invention is to provide a circuit closer for controlling the actuating means for railway gates. The circuit closers are placed along the railroad tracks a suitable distance on either side of the gate, and are designed to be operated by the wheels of a train to close the circuit in time to energize the actuating devices to lower the gates and temporarily close the crossing before the train which operates the circuit closer passes the point at which the gates are located

ANTI-SPARKING DEVICE FOR DYNAMO ELECTRIC MACHINES.—L. R. AUBERT and A. F. E. FERRAND, 20 Boulevard Diderot, Paris, France. The subject of the present invention is a device enabling parasitic fluxes to be almost entirely suppressed in rotary converters, consequently reducing the tension of reactance of the commutator section to a very low figure, which tension forms the chief cause of the production of sparks at the commutators. In principle the invention consists in surrounding the ring of the transformer with a metallic casing, in such a manner that the parasitic fluxes are compelled to traverse metallic screens in which are generated secondary currents tending to nullify these parasitic fluxes.

ADVERTISING MECHANISM.—G. T FIELDING, 375 Fordham Road, Bronx, New York The present invention has for its object to provide a new and improved advertising medium, more especially designed for use in show windows and the like, and arranged to display an advertisement in conjunction with an imitation snowstorm, thus rendering the advertisement extremely attractive This result is accomplished by using a transparency having a diaphanous front and back provided on its face with an advertisement and means for whirling flakes in imitation of snow through this compartment.

Of Interest to Farmers.

DITCHING PLOW.—E R. WILSON, Box 115, Worland, Wyo This plow is adapted to be used advantageously as a substitute for the ordinary plow, for cleaning out or deepening small side ditches or laterals of a main irrigating ditch This plow is provided with a mold board whose rear upper portion is curved laterally away from the side on which the share is located, so that it discharges earth on the land side of the plow, instead of on what may be called the mold board side, and is thus adapted to run close under a bank and to deliver the earth thereon

Of General Interest.

FUSE IGNITER.—R A. W KRAMPITZ, Valdez, Alaska. The principal object of this invention is to provide an igniter for lighting the fuses used in blasting The apparatus is so arranged that a tongue of flame may be directed away from the operator for engaging the fuse to ignite it at the end, to prevent burning the fuse or igniting it, except at the end remote from the blast.

CIGARETTE BOX.—A. MENDELSON and S. J GOLDBERG 482 Marcy Ave., Brooklyn, N. Y. Messrs. Mendelson and Goldberg have just secured six patents on boxes for cigarettes or cigars which when opened will relatively space the cigarettes, so that one may be removed from the box without touching or handling the others and fingering them In the first patent, cigarette holders are carried by one of the sections of the box and held in such position that the cigarettes will be spaced apart in crossed relation when the box is opened, whereas when the box is closed the sections will be hinged in alinement and will snugly fit within the box. In the second patent, a box is provided with supporting means for the cigars or cigarettes in the form of supporting sections pivoted or hinged to the box sections and connected with the latter in such a manner as to be moved away from the box sections a limited distance, but to collapse with the sections when the box is closed, means being also provided to normally project the cigarettes beyond the box sections when the latter are opened In the third patent the box is provided with a supporting member hinged in the box body and designed normally to move to an upright position when the cover of the box is opened. This supporting member carries holders, or clamps, designed to move into spaced relation automatically upon the opening of the box. In the fourth patent, the cigarette box is provided with hinged sections mounted therein to support holders for the cigarettes, while a supporting member is also rivetted in one or both sections, and by means of a connection with the opposite section of the box, is caused to move out of the area of the respective body or cover section in such a manner as to elevate the cigarettes by contact with the supporting sections carrying the same, the operation being wholly automatic upon the opening of the box. In the fifth patent, the object is to provide a box in which a plurality of holders are commonly connected so as to move in spaced relation when their carrying sections are moved outwardly, there being provided a central anchoring member in the box and a pair of outwardly moving holding sections. A sixth patent discloses a construction in which a plurality of holders are attached to an edge portion of one section of the box, comprising hinged sections, so that the cigarettes will be projected and will be capable of independent disposal in a position to be removed.

PENCIL HOLDER.—J. W. KYLE, 505 Marshall Ave., Memphis, Tenn. In order to hold a pencil securely in the pocket, Mr. Kyle has invented a holder consisting of a wire ring through which the pencil is passed, and an extension arm with a half loop at the lower end, adapted to bear against the body of the pencil. A spiral pin permits of fastening the holder to the pocket

SHADE BRACKET.—J. M. PARKER, care Charles V. Schwall, 55 E 59th St., New York. This invention relates to a bracket designed to receive the rectangular spring-controlled pintle of shade rollers, awning rods, and the like. It will be observed from the drawing that the



SHADE BRACKET.

bracket is provided with a novel arrangement of receiving recess with relation to the opening of the bracket and a recess in alignment with the opening, whereby the pintle can be inserted in a predetermined manner, but is incapable of accidentally releasing if the roller is subject to jolts or any other disturbing influence.

METHOD OF TREATING INGOTS.—H. W. HIXON, Box 11, Worthington, Ontario, Canada. In the present patent the invention relates to methods of treating ingots, the inventor's more particular purpose being to so produce the ingots as to avoid the formation of blow holes and to render the metal dense, smooth, and readily adapted for rolling

ANIMAL TRAP.—T. A. WILLARD, 1301 Fifth St., Port Arthur, Texas This trap is provided at its top with a trap door so arranged that when a rat or other animal attempts to eat the bait it will cause the trap



ANIMAL TRAP.

door to release and drop the rat into the cage. The trap door arrangement automatically resets itself so that any number of rats may be caught in succession before the trap has to be emptied

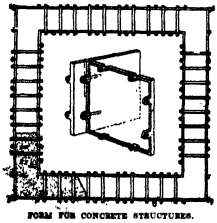
VENTILATOR FOR WINDOWS.—R. L. EDGERTON, Houghton, Mich. This improvement refers to a ventilator in the nature of an attachment that is applied to a window frame at the sill thereof so as to allow air to enter a room when the lower sash is partly raised, and the invention relates more particularly to a construction of the same designed to serve as a screen and ventilator of this character.

THERMOMETER CARRIER.—F. LEMPERS, Aisleben-on-the-Saile, Germany. This carrier is more especially designed for use on milk-heating vessels and other similar apparatus, and arranged to dispense with the use of specially constructed angular thermometers, to allow the use of an ordinary thermometer to test the same, and to permit of withdrawing samples of the liquid from the vessel to which the thermometer carrier is attached.

COMPOSITION FOR REMOVING COATINGS.—J. M. HUMPHREYS, 4816 Lafayette St., Dallas, Tex. The purpose of this invention is to provide a simple and efficient coating remover which will rapidly attack the coating and loosen the same from the surface to which it originally adhered, and it can then be removed from the surface by simply brushing or washing it off.

REINFORCED CONCRETE CONSTRUCTION.—W. APPLEBY, Napa, Cal. This invention provides a reinforcing plate with teeth projecting from the plate around holes therein, the teeth at each hole being bent laterally, substantially to the planes extending from the plate at the adjacent holes and parallel with the axes of the hole. The teeth extending from one side of the plate are bent laterally in general direction of the adjacent holes at the sides of which the teeth extend from the other side of the plate. Thus the cement will be held by the teeth at one side of the plate and will be directly united by the cement in the hole with the cement at the other side of the plate held by the teeth around the adjacent holes.

FORM FOR CONCRETE STRUCTURES.—J. S. O'KEIFF, 2803 Maple Ave., Altoona, Pa. The invention relates to forms or plates of suitable shape to be built into a mold to be used for concrete walls, the plates having such form that they may be readily connected together in different ways, and also as readily



FORM FOR CONCRETE STRUCTURES.

disengaged. Further, the invention provides an improved form of tie to be built into the wall, said tie being provided with means for facilitating the connection of the plates with each other and for bracing the wall molds as a whole until the concrete is set.

TYPE CARRIER.—A. E. STJERNBERG, 346 48th St., Brooklyn, N. Y., N. Y. The invention provides a type carrier on which different sizes of type can be easily and quickly set and adjusted and whereby the printed matter may be made to appear in straight or sinuous lines and in any desired relation to the border of the object on which the matter is to be printed.

FIREPROOF DOOR.—A. C. GODDARD, 406 E. 59th St., New York, N. Y. It is claimed for this fireproof door that it is insulated to the full size of the door opening, and when subjected to fire is not liable to warp or disintegrate, or have its sections come apart, even should the wooden core be reduced to charcoal. In its construction, use is made of a wooden core, wooden stile pieces, wooden rail pieces, inner and outer sheet metal coverings, and inner and outer layers of asbestos or other insulating material arranged between the core and the inner sheet metal covering and between the inner and outer sheet metal coverings.

PAPER SAFETY PIN GUARD.—W. F. SPENCE, 38 Howard St., Charlestown, Mass. For a safety pin of the type provided with a guard in connection with the usual coil at one end, so as to prevent the fabric through which the pin is passed from working back into the coil and becoming caught, the present invention provides an improved form of guard that is simple and inexpensive to manufacture. While this improved guard may be made of metal, it has been found thoroughly efficient when made of a heavy, stiff waterproof paper.

Hardware and Tools.

DRILL.—F. R. WEATHERBY, 512 Scanlan Bldg., Houston, Tex. This invention relates to drills of the general type disclosed in Mr. Weatherby's pending application, and patented November 4, 1913, his more particular purpose being to provide an improved form of shank, together with an improved form of disk detachably connected therewith, and means for connecting a disk or cutter with the disk.

LOCK AND KEY.—S. WALKER and A. SACHER, 124 E. 126th St., New York, N. Y. The invention provides a lock which can be used for various purposes to which locks are usually put, but which may have locking elements of a special key provided with one arrangement of cut, or an ordinary key, in which the key may be adjusted for use with different keys or with different adjustments of a special key, which cannot be operated in his authorized manner without great difficulty, in which the locking may be adjusted without the use of the key at all, and which comprises few parts and is cheap in form and inexpensive to manufacture.

DOOR-HOLDER.—IGNACE FRANCZKIEWICZ, 926 Waller St., San Francisco, Cal. Pictured in the accompanying engraving is a device for positively holding a door in an open position



DOOR-HOLDER.

so as to prevent it from closing, even when considerable force is used, but which will instantly release when the release mechanism is operated. The door-holder has comparatively few parts, and hence may be cheaply manufactured, and it is so designed that it is not liable to get out of order easily.

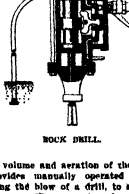
DRILL ROD COUPLING.—E. J. LOWE, Balboa, Canal Zone. Mr. Lowe's invention has reference to couplings for drill rods for holding drill points rigid relatively to the main rod, and it has for its object the provision of



DRILL ROD COUPLING.

means which will automatically take up any end all slack in the coupling, which may be occasioned by the wearing of the parts under the severe usage under which a drill is normally put.

ROCK DRILL.—J. T. CURNOW, Baltic Club House, Palatka, Mich. This inventor provides a drill and means for operating the same, adapted to introduce a aerated water-jet at the point of application of the drill head; provides simple and efficient means for control-



ROCK DRILL.

ling the volume and aeration of the water jet; and provides unusually operated means for cushioning the blow of a drill, to avoid breaking the same. The engraving shows a vertical section taken on the median line of a rock drill and jetting attachment.

Heating and Lighting.

BAKER'S OVEN.—G. H. MCCAUGHAN, 1740 Tasker St., Philadelphia, Pa. The invention discloses a construction in which means is provided for carrying away any steam which has escaped from the oven between the edge of the oven door and the wall or door frame. The oven door is of novel form, having channels along its edges with spaces for dissipating air through the channels to carry away the steam into a fine leading to the chimney.

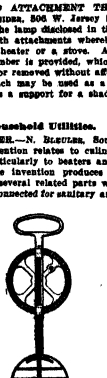
...CONSTRUCTION.—A. Mucha...Sweet Ave., Oregon, Ill., [illegible] ...the mounting the handles or molding of ...lower ends of the mental framework of a greenhouse, ...invention provides for so arranging the ...connecting bars with respect to the metal ...framework that the bars are approximately ...right angles out of contact with the latter, but ...firmly secured thereto. The isolation of the ...wood from the metal is advantageous, for the ...life of the wood is greatly prolonged.

INCANDESCENT GAS MANTLE.—J. L. Bamig, 24 Champside, and C. Weiss, 30 Randolph Gardens, London, England. This invention relates to inverted incandescent gas mantles, and has for its object to provide a mantle which can be produced very simply and cheaply, as it requires no skilled labor in its construction and no special packing when the mantle is to be transported. The mantle is formed from a number of flexible loose strands of any suitable material impregnated with a solution of rare earth compound.

LAMP AND ATTACHMENT THEREFOR.—A. E. Schneider, 806 W. Jersey St., Elizabeth, N. J. The lamp disclosed in this patent is provided with attachments whereby it may be used as a heater or a stove. An article-supporting member is provided, which may be easily applied or removed without affecting the lamp, and which may be used as a stove attachment or as a support for a shade for the lamp.

Household Utilities.

EGG BEATER.—N. Reuther, South Bend, Ind. This invention relates to culinary apparatus, and particularly to beaters and stirrers generally. The invention produces a rotary beater having several related parts which may be readily disconnected for sanitary and cleans-



EGG BEATER.

ing purposes, the device consisting of the fewest possible number of separate parts and adapted to occupy a minimum amount of space proportional to its agitating or beating efficiency.

WINDOW SCREEN.—J. C. Smith, 220 Swetland Bldg., Portland, Ore. This invention relates to window screens, and one of the principal objects thereof is to provide a screen having a housing therefor to protect the screen from the elements, and also to provide means for folding the edges of the screen as the same is raised or lowered

RUG FASTENER.—R. K. Myers, 10911 Hathaway Ave., Cleveland, Ohio. In order to fasten carpets or rugs to the floor, Mr. Myers provides an inexpensive device which can be easily and quickly secured to a rug and then removably affixed to a floor. This fastener will hold the rug securely and will be unobtrusive.

IRONING BOARD ATTACHMENT FOR TABLES.—J. and L. Meirasch, 398 Madison St., New York, N. Y. The invention relates to ironing board attachment for kitchen cabinets or other tables. An ironing board of peculiar construction is provided, which is mounted within or beneath the table top when out of use, leaving the table top smooth and clear for the usual purposes. When in position for laundering, a portion of the table will be lifted and tamed back, causing the ironing board to be elevated, and there supported in steady, stable position.

Machines and Mechanical Devices.

TOOL FOR TREATING ARTIFICIAL STONE.—J. O. Ehrg, New York, N. Y. This invention provides a tool having a casing with projections for engaging a member to be finished, and with a shaft journaled in bearings in the casing and having a cutting head, the shaft and the cutting head being held yieldingly expanded within the projections by a spring in the casing.

SPROCKET AND CHAIN THEREFOR.—C. P. Brownell, Salt Point, N. Y. This invention relates to an improved sprocket and chain adapted particularly for translating rotary motion into reciprocating, whereby from a given rotation any desired reciprocating length of stroke may be provided. An object in view is to provide a chain and sprocket formed with means for preventing the chain from sagging and with means co-acting with the flange on the sprocket wheel for withstanding side pressure.

RAIL CONCENTRATOR.—R. H. Dannar, Cloverdale Box, Cal. The invention has particular reference to means for acting mechanically for the separation of dry ores. Among the objects is to provide a machine having various adjustments or capabilities of action so as to meet the demands of various types or conditions of ores to be treated.

PIPE FLANGING MACHINE.—W. J. Hatzon, Escanaba, Mich. This machine is designed rapidly and reliably to form the ends of lead pipes with flanges in connection with bushings or collars, whereby such pipes may be



PIPE FLANGING MACHINE.

connected to each other by any suitable coupling means acting through said collars, and whereby the usual wiped joints may be avoided

MONOPRINT MULTICOLOR ATTACHMENT FOR PRINTING PRESSES.—E. H. Hobbitt, 804 Eureka St., San Francisco, Cal. This invention has for its object to provide an attachment for printing presses having a sectional strip for use with a plurality of colors, and a sectional reciprocating roller, the sections of the latter engaging the sections of the strip respectively for distributing ink on the latter.

SCALE.—I. Chasey, 552 Sutter Ave., Brooklyn, N. Y., N. Y. The principal object here is a construction or articulation between the actuating mechanism and the indicating mechanism. In the performance, means are utilized which tend to cause movement of the pointer over the scale, such means being held inoperative, the said means fluctuating, however, when a load is placed on the scales.

GRAMOPHONE RECORD CLEANER.—W. G. Pearson, Plummer Ave., Newburyport, Mass. This improvement comprises a cleaner for gramophone records, the construction and arrangement being such that records may be cleaned thoroughly and in a short time. The device being inexpensive in its make-up, whereby it may be offered at a low price.

PROPELLING OR RECEIVING FLUID REACTION ENGINE APPERTAINING APPLICABLE TO AERIAL NAVIGATION.—G. Deraulles, 21 Rue Georges Sand, Paris, France. This invention provides a device for obtaining in transformations of work a better utilization, and, especially in the case of aerial navigation, to give to the device more powerful means of action, a greater stability, and, consequently, a more extended sphere of action. In the invention, it is the reaction created by the very movement of the machine, reaction of the fluids, under the influence of the speed and centrifugal force which place the elements in their most advantageous position either for supplying of generating work or for offering the minimum resistance to the movement.

METAL PRECIPITATING DEVICE.—F. A. Rose, Spokane, Wash. Address Engineers & Williams, Chicago Heights, Ill. An object here is to provide a device in which the metal precipitant is broken up into small parts and in which these parts are constantly agitated so as to cause the engagement of one particle by another, thereby keeping the surface of the metal bright and clean, thus expediting the process.

TYPE WRITER.—M. N. Theobe, care of Secretary Commonwealth, Harrisburg, Pa. This inventor provides a device in which the type bars are carried in a segment which may be shifted vertically for writing capitals or upper case letters, and in which, means is provided for dispensing with certain operations which are necessary in the ordinary machine, thus rendering the device capable of greater speed.

Prime Movers and Their Accessories.

ATOMIZER.—E. J. Franklin, 1810 W. 10th St., Los Angeles, Cal. This atomizer has a spraying nozzle located within the mixing tube, so that the lubricant can be divided and distributed before it issues from the outlet. This outlet is preferably located in the conduit through which the motive agent is supplied to the engine, and is so located that it faces the direction in which the motive agent is flowing. The device is for use in supplying lubricant to steam, gas, air, or other engines. Mr. Franklin has invented another atomizer to supply lubricant to the above-named types of engines, and so constructed that it can be used with oil, graphite, mica, or any other lubricating material. The atomizer can be caused to project into the conduit which supplies the motive agent to the engine, and in practice will have its discharge aperture turned against the direction of flow of the motive agent, so as to make the atomizing action and distribution of the lubricating material more efficient and uniform.

AIR VALVE FOR INTERNAL COMBUSTION ENGINES.—A. G. Gassuvt, Statenville, Ga. This inventor provides a valve, automatic in its action, and controlled by the degree of vacuum obtaining in the manifold pipe, so as to increase the air supply as the vacuum diminishes, and to diminish the air supply as the vacuum increases

PUMP OR MOTOR.—F. Reagon, Oak Cliff, Texas. The pistons of this machine are mounted on the rotor to revolve around the stationary cone and also to rotate at uniform speed on their own axes, this rotation being so timed that, while they pass through the working chambers broadwise, they turn to pass through the throat edgewise. The pistons are slightly thinner at the edges, so that they and the intervening flanges are always a close fit in the throat and prevent fluid leaking therethrough. The pistons are perfectly balanced, all their motions are evenly rotary, and they enter and leave with a feathered movement

GAS ENGINE.—P. Sumbler, care Agnew & Agnew, Plattsburg, N. Y. Among the objects of this invention is to provide a means for operating the engine valve, the ignition timer, and other necessary auxiliary working parts without the use of spur, bevel, spiral, or other toothed gearing. A further object is to render it more simple to take down and reassemble an engine for repairs or inspection, and to make the engine lighter and more compact.

Pertaining to Recreation.

ARTIFICIAL FISH BAIT.—L. Schell, Jr., Echo, Ore. This invention is an improvement in artificial flies, and consists more particularly in the attachment of the leader to the upper portion of the hook shank and in the



ARTIFICIAL FISH BAIT.

arrangement of the head portion of the body of the fly on the tail of the shank or at a point above the attachment of the leader, whereby important advantages are attained.

KNOCKDOWN CAROUSEL.—S. W. Brundage, Leavenworth, Kan. The inventor provides improvements in knock-down carousels or merry-go-rounds, whereby the parts can be conveniently and quickly assembled and securely fastened in place when setting up the carousel, and the parts can be quickly disassembled whenever desired to take the carousel apart for shipping or storing purposes.

Railways and Their Accessories.

TRAIN PIPE COUPLING.—H. O. Wyman, New Hamburg, Ontario, Canada. This automatic coupling is arranged to insure an automatic coupling of the train pipes of two cars coming together, to cut off the fluid pressure in the train pipes on the cars being uncoupled, to cause an emergency application of the fluid pressure brakes in case the cars accidentally break apart, and to provide electrical connection between adjacent cars for a train circuit telephone and electrical signal system, and for electric power transmission, either lighting or motive power

AUTOMATIC TRAIN TRACK TRIP.—J. S. Allen, 115 Broadway, New York, N. Y. This invention provides a trip having a hollow post in which a shaft is journaled, a hood being secured to the top of the shaft and having depending lugs which engage stops on the post for limiting the movement of the hood and the shaft. The hood extends outward from the shaft and has a depending peripheral member for protecting the stops and lugs from the weather. Secured to the hood there is an extending arm which is adapted to be engaged by a contact member carried by a locomotive or car.

RAIL BRACE.—R. Sargent, Leona, Wis. In this brace clamp members are provided to engage track rails at the outer side, and these are united by a turn-buckle or equivalent to tighten or loosen the clamp members as desired. Associated with the clamp members are bearing plates seating against the rails, and means associated with the clamps to engage the rails at the inside

CENTERING DEVICE FOR CAR COUPLINGS.—L. Bonnaire, 88 Rue Taitbout, Paris, France. This invention has reference to a device for the purpose of so directing the coupling of bogie railway cars, when running either on the curved or straight parts of the line, that the head of the coupling will be kept substantially in the axis of such line.

Pertaining to Vehicles.

SNOW PLOW.—J. A. Lawrence, 106 Elm St., Valparaiso, Ind. This snow plow is provided with a pivoted thill and draft member to which the tug straps of the harness may be attached, so that the plow may be operated to clean a straight path in the open, in a gutter, or against the building, throwing the snow to either or both sides, irrespective of drifts. Means are provided for locking the draft members in any one of a number of positions relatively to the plow.

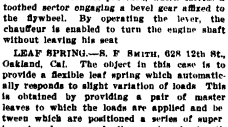
VEHICLE WHEEL OR RUNNER.—A. E. Moore, Box 664, Mt. Vernon, Wash. The invention relates to vehicles in which the tread consists of an endless element that travels around the inner frame or fixed section of the runner. The tread mechanism is provided with anti-friction devices between the outer movable element and the inner fixed element.

AUTOMATIC STARTER.—B. S. Williams, 17 Arcade, Nashville, Tenn. The invention relates particularly to mechanism for starting internal combustion engines of automobiles. For this purpose a fluid under pressure is employed, and after the engine has started its power is used to replace the fluid in a suitable position for starting again at some future time.

HAND WHEEL.—H. W. Down, Bark Road, St James End, Northampton, England This invention relates to the construction of hand wheels, more particularly to steering wheels of motor cars and the like, which are built up of a peripheral rim, a central hub, and intervening arms An object of the invention is to securely attach the outer ends of the arms to the rim by means which permit of making the rim itself in an economical manner, and at the same time enabling it to resist efficiently the stresses to which it is subjected.

ENGINE STARTER.—M Meller Zakomelsey, 816 W. 23rd St., New York city This improved starter for the internal combustion engines is particularly adapted for use in connection with automobiles Adjacent to the chauffeur's seat a lever is provided, which carries a toothed sector engaging a toothed gear affixed to the flywheel. By operating the lever, the chauffeur is enabled to turn the engine shaft without leaving his seat

LEAF SPRING.—S. F Smith, 628 12th St., Oakland, Cal. The object in this case is to provide a flexible leaf spring which automatically responds to slight variation of loads This is obtained by providing a pair of master leaves to which the loads are applied and between which are positioned a series of superimposing leaves gradually varying in length



LEAF SPRING.

with the longest leaf adjacent the lower portion of the leaf spring and the upper master leaf contacting with the ends of all the leaves positioned between said master leaves The leaves of varying length between the master leaves are prevented from displacement by means of connecting the master leaves at certain intervals.

RESILIENT WHEEL.—W. S. Hait, Chicago, Ill. An object here is to attach a tire, preferably of solid construction, to a wheel in such a manner as to obtain all the advantages appearing in a pneumatic tire, and, at the same time, avoiding the possibility of the pneumatic tire being injured or punctured.

CRANKING DEVICE.—J. D. Horwood, 712 Huntsville Ave., Boyles, Ala. In this invention the object is to provide a device particularly adapted for use with automobiles or with explosion engines in general, and wherein means is provided for preventing reverse movement of the crank in case of back-firing or the like

Designs.

DESIGN FOR A STATUETTE.—T. B. Foss, 407 Broome St., New York, N. Y. In this ornamental design a winged insect whose head is that of a man with an elongated proboscis is inserted among a mass of ball-shaped forms, all resting on a base.

DESIGN FOR MATERIAL FOR APPLIQUÉ WORK.—E. E. Maul, 185 Mercer St., New York, N. Y. In this ornamental design for appliqué work, the design shows three rows of twisted material in running loop form, slightly differing from one another, the whole having a line along the edge of the pattern.

Note.—Copies of any of these patents will be furnished by the Scientific American for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper

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We wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialised, technical, or scientific knowledge required therefor

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Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(13009) L. R. asks: Will you kindly answer in your Notes and Queries column the following questions about sulphurous acid gas? 1 What is its density as compared with atmospheric air at these temperatures, 40 deg., 60 deg., 80 deg., and 100 deg. Fahr.? A. The density of sulphur dioxide gas is about 2 25 times that of air at the same temperature. Its coefficient of thermal expansion is about 0.002, so that from 40 degrees to 100 degrees it would expand about 0 012, a little over one per cent. 2. As compared with carbon monoxide and dioxide. A The density of carbon monoxide is 0 967, and of carbon dioxide is 1.529, air being unity. 3 What is its rapidity of diffusion? A We have no figures for the diffusion of sulphur dioxide into air. 4. What volume of gas from one pound of sulphur? A. By the burning of one pound of sulphur in oxygen, a little more than 11 cubic feet of sulphur dioxide will be formed

(13010) J. M. asks: 1. I am informed that ice boats can go faster than the wind that fills their sails under certain conditions. Will you kindly explain the reason? A When an ice boat is sailing by the wind, so that the wind moves less than the length of the boat while the boat moves its length, the boat will go faster than the wind. This is because the friction of the ice is so slight. It can never occur in the water because the boat must push its own weight of water aside every time it moves its own length. This the ice boat does not do It only overcomes the friction of the ice It has long been known that an ice boat could go faster than the wind which drove it along Thirty to forty years ago the question was most hotly discussed, but we have seen no dispute about it for a long time 2 I attended a lecture recently on light, shade and color The lecturer told us that the reason of red in the case of red glass, was because it absorbed all other color rays, transmitting red alone Assuming that red glass absorbs blue and green rays, when we place a blue glass in front of the red glass, why doesn't the blue glass absorb the red rays and leave zero instead of purple? A If you had a red glass which would absorb all the wave lengths excepting red, and a blue glass which would absorb all the red wave lengths, when the two were placed one over the other no light could come through both glasses. The reason why you get light through a red and a blue glass placed one over the other is that they transmit other waves than those of their simple colors It is easier to find liquids than glasses which will illustrate this point If red aniline is dissolved in amyl alcohol and copper chloride in dilute hydrochloric acid, two solutions may be formed which will completely absorb all the light, and this with quite a variation in the depth of the colors of the solutions The liquids may be put into the same container and shaken up, giving a black liquid. They will rapidly separate again They will not dissolve in each other, and remain mixed If the two liquids are put into separate cells, they may be examined by the spectroscope and the absorbing power of each separately or of both together, be measured.

(13011) G. N. G. asks: What becomes of the flame of a match, candle, etc., when same is extinguished? A. The gases which compose the flame of a match are simply cooled below the shining temperature when the match is blown out, and are left in the air where they were and in the same condition The shining part of the flame is composed of particles of carbon which when cooled are soot, and can often be seen in the air as smoke when they are cooled In the flame while hot these are transformed by the oxygen of the air into carbonic acid This is the gas which is the usual product of burning.

(13012) J. T. asks 1. Why do the sun and moon appear larger when near the horizon? A The sun and moon appear to be larger when near the horizon by an optical illusion We contrast them with near objects, and so think them much larger than these objects, as indeed they really are To destroy the illusion and see them as they appear when high above the horizon, roll a paper tube around a lead pencil, making the tube about 12 inches long. Through this you can only see the moon, and thus cut out the view of intervening objects With one eye look through this tube, the moon will shrink to its proper size Then close this eye and open the other Instantly the illusion returns Open and close the eyes alternately. The eye which looks through the tube is never deceived, because the tube cuts off all view of intervening objects This experiment is given in Todd's "New Astronomy," page 241. We send the book for $1.45 by mail, postpaid. 2. When is the North Star directly north, at 96 degrees west of Greenwich, and when is it out the most? A The North Star is directly north, that is, on the meridian of any place twice in every 23 hours 56 minutes 4 seconds of mean solar time, once above and once below the pole. If you wish the time exactly, for any particular date, we would advise you to apply to the Department of Astronomy of the University of your State 3. What is the variation of the compass needle at 45 degrees north latitude and 96 degrees west longitude? A The nearest data we can give you for the magnetic variation at your place is 9 degrees and about 40 minutes east in 1902, but we have no record of the annual change since that time. Your State Survey can doubtless give you figures much later than these.

(13013) H. M. sends us the following, which may be of interest to the readers of the Notes and Queries column: Once the question was asked in your columns how to use gradually food sealed in glass jars. I have found a successful method White glass nest eggs are sold everywhere for about a cent apiece. As the food is used from the jar, these glass eggs can be put in to fill up If lacking, a little water can be added. This plan is useful also when canning, when the last one is not filled. Also it admits of using larger jars safely for small families. In summer, any cooked food might be put in jars till next meal or next day.

(13014) C. A. B. asks: I have just read your article on "Lightning Protection for Dwellings." I would like a little information on the striking of lightning. I have understood or read in your paper that when a building is destroyed by lightning, the electricity that causes the destruction comes from within the building, and not from the cloud, as it appears to the eye. The real destruction is caused by an explosion from the passage of the electricity stored in the building to the atmosphere or a cloud. Am I right in this matter? A When an electrified cloud comes over a place, it draws an equal charge of the opposite kind of electricity up into the surface of the earth, the houses, tree tops, etc. If the cloud is positively charged, the earth underneath has an equal negative charge A flash of lightning is the combination and mingling of these two charges In this way, the damage results to the objects in the line of the discharge.

(13015) S. U. C. asks: Why is cow's milk white or nearly so; that is, of what is the white color in milk composed, and where does it come from? Why does it stay white, no matter whether a cow feeds on green grass, ensilage, corn, bran, etc? A. The whiteness of milk is due to its being an emulsion of fat and other substances in the milk. The whey from cheese is not white, after all these substances are removed from it. All emulsions are white. This is due to the action of the tiny particles in the emulsion upon the light which strikes the emulsion. Soap suds is white for the same reason. It is an effect upon the incident light The white petals of flowers are still another example. They are cells containing air only

(13016) E. D. T asks: I am interested in thermo-electric currents and would like you to answer the following questions in regard to the same 1 Does a firm contact between two different metals in a closed circuit produce an electric current when the point of contact is heated or cooled to a temperature different from the rest of the circuit? A. A firm contact is absolutely necessary to the production of a thermo-electric current. The electro-motive force is so small that a loose joint would introduce so great a resistance that no current could be detected. 2 If so, why the instructions to solder the joint? All discussion of the matter that I have seen or heard speaks of the joints being soldered A. The joints are usually soldered to produce as firm a contact as possible A riveted joint will soon corrode when heated and become loose, or else the oxide in the joint, not being a conductor, would ruin the contact 3 Does the solder have any effect on the results other than to hold the parts firmly together? A The solder is for the purpose of holding the joints together and excluding air to prevent corrosion. 4 Can you recommend any book treating on thermo-electricity in large part or perhaps exclusively, and not too technical for the semi-amateur? A There are no separate text books on thermo-electricity The best references are to the larger texts of physics, Ganot and others. Valuable articles may be found in our SUPPLEMENT, Nos 195, 238, 645, 752, 767, 811, 826, 1072, 1531 and 1952, price ten cents each mailed.

(13017) C. M. P. asks: During a recent thunderstorm here, the reverberation was so marked that I write to ask for some explanation of it Although the flash preceded the thunder by several seconds, indicating some distance, the resulting sound was not only louder after the first report, but the concussion of each successive report was greater, so much so that my house was shaken as if by heavy blasting. It resembled heavy artillery fired at intervals of perhaps a second, totaling from five to eight such reports from each flash, the second, third or fourth being louder and heavier than the first Can you give any scientific reason for this concussion feature? A The reverberation of thunder is usually attributed to the reflection of the sound from surfaces of the clouds at different distances from the ear, so that at one moment a large volume of sound and at another a small volume reaches the ear. In the case which you describe, the banks of cloud must have been so placed that several reflections came to you at the same moment, producing a heavy shock. Then too, there may have been successive reflections of the sound before it reached you, and so the combined effect was much greater.

NEW BOOKS, ETC.

THE PIGMENTS AND MEDIUMS OF THE OLD MASTERS. With a Special Chapter on the Microphotographic Study of Brushwork. By A. T. Laurie, M. A., Principal of the Heriot-Watt College, Edinburgh, and Professor of Chemistry to the Royal Academy, London. London: Macmillan & Co., 1914. Price, $2.75.

The name of Prof. Laurie should be familiar to readers of the SCIENTIFIC AMERICAN. He will be remembered as the contributor of an article on "The Microphotographic Study of Brushwork," in which he convincingly showed how it was possible by means of the microscope and the camera to distinguish the product of one master from another.

In this book Prof. Laurie systematically analyses the pigments used in old illuminated manuscripts, in paintings and on colored statuary. He shows how the date of any given art work may often be accurately determined by a chemical analysis of its pigments. By far the most valuable portion of the book, to our mind, is the concluding chapter on Micro-photography. Here the most definite and scientific directions are given for the instrumental study of brushwork. To anyone of scientific leanings this objective method of passing upon the authenticity of a work is much more satisfactory than the conflicting testimony of experts, much of which is merely personal opinion. The more knowledge of Prof Laurie's kind that the expert can command, the more of an expert he really becomes. Prof Laurie has presented a decidedly original and instructive work which should do much to improve the present methods of passing upon old masters.

DER GESICHTSAUSDRUCK DES MENSCHEN. Von Dr. med. K. Krukenberg. Stuttgart: Verlag von Ferdinand Enke, 1913. Pp. 264.

The old books on physiognomy contained little if anything of scientific value. They were written by men who were more often visionaries than scientists. Physiognomical research in the past—if it deserves the name research at all—is a curious composition of chiromancy, astrology and phrenology. And yet there can be no question that the subject is one which is not only of great artistic and practical value, but one which lends itself to scientific inquiry. Dr. Krukenberg has succeeded admirably, to our mind, in clearing away the meaningless rubbish that has hitherto been accepted as scientific elucidation, and has written a work on physiognomy which has substantial scientific value First discussing the facial expression of animals, he lays the basis for his thesis that there is an intimate relation between the musculature of the face and intellectual ability. In an admirable chapter on the physiognomy of primitive human beings, he explains his subject anthropologically. In the "Origin of Human Facial Expression" he discusses the evolution of the face, its physiology and pathology. Such individual organs as the eye, the nose, the ear and the mouth and the part they play in physiognomy are excellently treated To those to whom a study of the human features is of primary importance Dr. Krukenberg's book may be recommended.

METRIC-ENGLISH AND ENGLISH-METRIC LENGTHS. By G. A. Rossetti. New York: Spon & Chamberlain, 1913. Price, 40 cents.

This is a little pocket-book giving equivalents in millimeters (to five significant figures) of all English lengths from one sixty-fourth of an inch to ten feet, advancing by sixty-fourths of an inch, and equivalents to the nearest sixty-fourth of an inch of all metric lengths from one to three thousand two hundred millimeters, advancing by millimeters.

HANDBUCH FÜR UNTERSUCHUNGSRICHTER ALS SYSTEM DER KRIMINALISTIK. Von Hans Gross, O.Ö. Professor des Strafrechts an der Carola-Franciscoa Graz. Sechste, Umgearbeitete Auflage. München, Berlin und Leipzig: Verlag J. Schweitzer (Arthur Sellier), 1914.

Prof. Gross's monumental work has long been the standard authority on the scientific detection of crime in Europe. That it should have reached a sixth edition (an edition which may be regarded not simply as a revision of the one which preceded it, but almost as an entirely new work) shows how completely it fills the wants of those students who feel that the *facts* of crime should be studied as well as the *law* of crime. Prof. Gross must be regarded as a pioneer in the field of criminalistics—a science which, following the example that he has set at the University of Graz, is now taught in four European universities and which is intended to teach the criminalist (judge, lawyer, detective) how a crime should be systematically analysed, both psychologically and physically, in order that the guilty criminal may be most speedily brought to justice Prof. Gross has introduced the technical methods of physics, medicine, bacteriology and other sciences into a field where there has been nothing but blundering and guessing.

It is amazing to learn from Prof. Gross's two stout volumes what an enormous mass of information he and his disciples have accumulated in the last twenty years. It is still more amazing to find all this information wonderfully systematized and so organically presented [illegible] indubitably conveyed [illegible] as it is, indeed a science. Only a man of Prof. Gross's encyclopedic knowledge and experience [illegible] was an Austrian Examining [illegible] he became a university [illegible] duced this work. [illegible] judge, the [illegible]

The fifth edition of [illegible] translated into English [illegible] abridged form in India. It is [illegible] the sixth edition, a totally [illegible] we have said, will [illegible] publisher.

PHOTO-CHEMISTRY. By S. E. Sheppard, D. Sc. (London). (Text-Books of Physical Chemistry, edited by Sir William Ramsay.) London: Longmans, Green & Co., 1914. Crown 8vo; [illegible] pp. Price, $3.50 net.

A book belonging to the series of text books edited by Sir William Ramsay requires no special recommendation. The present volume represents an excellent survey of a field of chemistry which is as yet incompletely worked out, and the literature of which is greatly scattered. Just because this is so, a particularly high standard of clearness of exposition should have been aimed at. The reviewer regrets to say that on this point the volume is somewhat disappointing. There is a super-abundance (unnecessary, it would seem) of rather unfamiliar technical terms, some of which (e. g., homodrome, heterodrome) might well have been explained, or else omitted. German influence is shown, not only in the very high order of scientific merit of the book, but also in a much less commendable tendency to run into long sentences. An example of this is found on page 230, a sentence which would betray German influence even if it did not end in a German quotation. Says the author.

"In the ensuing sections, we shall see that the photo-chemical reactions which we are at present considering, initiated and to some extent maintained by coherent radiation from definite light sources, are continued, subsequent to the cessation or shutting off of such intensive radiation, by complementary processes of chemi-luminescence, and that whatever persistent chemical changes go on, there is considerable reason to credit the continuance of the propagation of radiant energy, of light, invisible and visible, which, in the words of a pregnant saying, 'leitet das organische Wesen en.'"

An idea of the scope of the book may be gathered from the chapter headings: I. Historical. II. Measurement of Light Quantities. III. The Energetics of Radiation. IV. Economic and Energetic Relations of Actual Light Sources. V. The Absorption of Light. VI. Statics and Kinetics of Photo-chemical Change. VII. Dynamics of Photo-chemical Change. VIII. Special Photo-chemistry. IX. Radiant Matter and Photo-chemical Change. X. The Genesis of Light in Photo-chemical Change. XI. Organic Photo-synthesis.

A HISTORY OF PENAL METHODS. By George Ives. New York: Stokes & Co., 1914.

A gift of picturesque and virile writing has enabled Mr. Ives to write a history of penal methods which holds the attention like a novel. But exceptional literary gifts are not always accompanied by sound judgment. It is true that vengeance was the old idea of punishment; true that it still plays a predominating part in modern prisons; true that severity of punishment does not deter thieves from stealing, or murderers from killing. But it is not true, as Mr. Ives holds, that the term "prison keeper" is synonymous with corrupt official; that single confinement is invariably injurious to mind and body; and that prisons are necessarily schools for habitual criminals. Modern penologists are well aware that the administration of a prison is fraught with shocking possibilities for corruption, both of keepers and of prisoners; but as the science of prison management advances, as criminologists are supplanting the old-time prison officials, the dangers to which Mr. Ives draws attention are fast being eliminated.

Where Mr. Ives is strongest; where, indeed, we heartily endorse him and wish that every American prison warden would read what he has to say, is that portion of the book in which he deals with the future of penology and with prison reform. He has a fine constructive plan, which, idealistic as it is, strikes us as eminently practicable. Before any reform can be proposed or carried out, it is necessary to study and classify crime. That Mr. Ives has done. He distinguishes between the "impulsive" and the "circumstantial" criminal; in other words, between the emotional type of man, whose hot temper leads him to the commission of an act for which he is afterward deeply remorseful, and the deliberate professional. Only the "circumstantial" or professional type of criminal should be confined, according to Mr. Ives—in a prison, by the way, which seems to us very like the prisons that Mr. Ives has condemned in previous chapters. But what is to be done with the prisoners? Analyze them and treat them according to the analysis, answers Mr. Ives. Those that can be reformed are to be [illegible] Certain types of criminals [illegible] criminal tendencies, habitual criminals who have been convicted over and over again [illegible] actually destroy, humanely [illegible] proceeding, however, which can hardly be entered upon quite so lightly as Mr. Ives seems to suggest. Some crimes can undoubtedly be eliminated altogether by appropriate legislation [illegible] example, as certain forms of [illegible] are dependent upon the [illegible] to control certain [illegible] controlled.

Mr. Ives's book will [illegible] best [illegible] written work.

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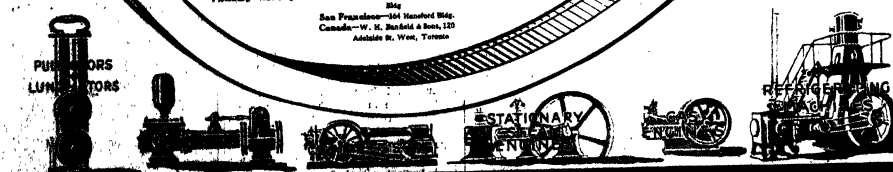
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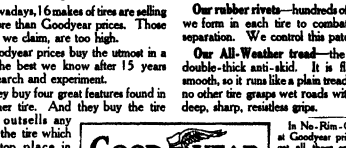
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ON July 4 the Saxon car finally demonstrated its independence of all road conditions. For on that famous day a Saxon car reached San Francisco, having traveled 3,389 miles overland from New York, in 30 days, across the Lincoln Highway—the first automobile to make a continuous trip from New York to San Francisco over the Highway and the first car of its size and price to make the journey from coast to coast.

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Recent American and European Express Locomotives

(Concluded from page 69.)

been delivered from the Maffei Works, Munich, for service on the Roumanian State Railways. One of the outstanding features of these powerful machines is the exceptional dimensions for European practice of the boiler, which has a heating surface of 3,378 square feet and surpasses the capacity of the boilers of all other European Pacific locomotives. The Schmidt superheater, of 650 square feet heating surface, supplies a steam temperature ranging from 570 to 610 deg. Fahr. The fuel used is oil and soft coal. Oil burning has been adopted, as the Roumanian government owns a number of oil wells which have been extensively developed during recent years, but technical reasons made it desirable to combine coal burning with oil fuel. When the locomotives are descending long gradients or standing in the stations, where the petroleum injection would be interrupted as the boiler is not steaming, the temperature of the firebox and tubes would be reduced and endanger the tightness of the joints. This is avoided by burning a thin layer of coal on the grate. Two petroleum injectors are arranged on the firebox of the "Pragu" pattern. A second series of these locomotives is fitted with one flat flame burner of the Cosnovici pattern. The oil is injected by dry steam taken from the boiler. Both oil and steam are regulated with valves and nozzles. A reheater is arranged, beyond the footplate of the cab, to heat the oil before reaching the injectors. This is also done by live steam, which is taken by piping from the reheater to a warmer coil in the oil tank on the tender.

The boiler barrel contains 254 fire tubes 17 feet 7 inches long. The smokebox is of somewhat remarkable dimensions, having a length of 10 feet 7¼ inches.

Half these locomotives are fitted with a third injector of smaller capacity designed for continuous feeding. The eight-wheeled tender has a capacity of 4,600 gallons of water and 1,320 gallons of oil. The capacity of the coal bunkers is 4 tons. The engines under notice are used on passenger express service to haul trains with a maximum speed of 78 miles per hour.

The general dimensions are as follows:

Steam Pressure	185 lb per sq. in.
Heating Surface of Firebox	193 sq. ft.
Heating Surface of Tubes	2,530 sq. ft.
Heating Surface of Superheater	650 sq. ft
Total Heating Surface	3,373 sq. ft.
Grate Area	43 sq. ft
Diameter of Cylinders	16⅞ in
Piston Stroke	35½ in.
Diameter of Driving Wheels	6 ft. 1 in
Weight on Driving Wheels	46 tons
Weight Empty	90 tons
Weight in Working Order	89 tons
Gage	4 ft 8½ in.

Will the Cyclecar Come Into Its Own?

(Concluded from page 79.)

be borne in mind that it is the low cost of upkeep that is the primary desideratum of the cyclecar purchaser, and that, therefore, excellence of design, strength of construction, and reliability of operation should not be sacrificed in order to save a few dollars on the manufacturing cost. Naturally, light weight, without attendant sacrifice in strength of parts, is an important consideration in lowering the cost of maintenance. With a 700-pound cyclecar loaded with two 150-pound passengers, the weight on each tire is but 250 pounds. This comparatively light weight carried by each wheel will not only admit of the use of small tires that cost not over $12 each, but also enables the driver to obtain greater mileage on one set than would be the case were the ordinary weight per inch of tire carried on each wheel. And with the greatest source of automobile upkeep cost reduced to a minimum, gasoline and oil expenses naturally follow suit. Many manufacturers claim that their cyclecar will travel 50 miles on a gallon of gasoline, which may or may not be the case, but even if we reduce this figure by 30 miles to make allowance for possible over-

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PATENTS

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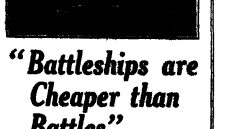
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enthusiasm, the remaining 40 miles per gallon is so far superior to the performance of the average automobile that it becomes, to many men, a powerful argument in favor of the lighter vehicle.

"Granted that the cycle-car possesses these advantages of low initial cost and upkeep, its light weight renders it unavailable for comfortable riding over the average rough country road; it is suitable for the boulevards and well-kept State roads, but is it not entirely a fair-weather and smooth-highway vehicle?" the automobile owner will argue. In reply it should be stated that the cycle-car has upset every common belief in regard to the features of design and construction on which *comfortable* riding over rough roads depends. It is ordinarily held that a heavy car with a long wheelbase will be able to negotiate rough roads with less attendant discomfort to the passengers than will be the case with a smaller and lighter car; it is argued that the greater weight absorbs the shocks and jars before they are communicated to the occupants of the machine. This is true to a certain extent, but the more comfortable riding found in a heavy car is not due directly to the greater *total* weight, but rather to the greater proportion of sprung to unsprung weight. That is, the wheels, axles, differential, driving shaft, and the like, the weight of which is carried entirely on the tires, represent a certain mass of unsprung weight that is directly affected by the inequalities of the road. All of the remainder of the weight of the car, including body, frame, transmission, motor, and occupants, is mounted on the springs. If the unsprung weight is heavy and the spring-supported weight is light, the shocks imparted to the latter by travel over a rough road would be tremendous. When the reverse is the case, however, the *comparatively* small mass of the unsprung parts reacts through the springs against the much greater mass with but little effect on the latter. Therefore, as motorcycle wire wheels, light axle construction, and the elimination of the differential are features of cycle-car design, the unsprung mass is very small as compared with the spring-supported weight of the frame, body, motor, and occupants, and this results in a wonderful ease of riding that, it is claimed, is oftentimes not found on the most expensive cars when traveling over exceedingly rough roads.

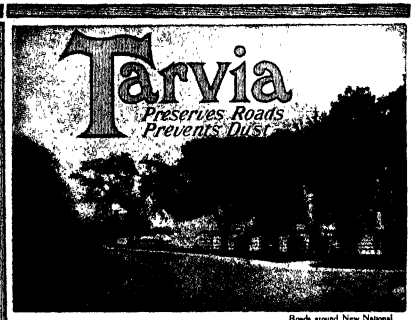
There is another feature of cycle-car construction that is cited as a decided objection by many of its opponents, and that is the narrow tread. But if we are to have a car of minimum weight and cost, the tread must be narrow, for this makes possible the use of shorter and lighter axles and a smaller frame. Furthermore, instead of being forced to follow in the deep ruts of a country road, the cycle-car of 26, 40, or 48-inch tread is able to travel in the center or crown of the road, or to "straddle" one or the other of the ruts. In addition, the low center of gravity of the average cycle-car enables it to run on a sidehill or in a gully without danger of overturning, and if the tread be sufficiently narrow, the side of the road may be taken with ease whenever an obstacle is encountered in the center.

Desiccated and Frozen Eggs

(*Concluded from page 82.*)

room is provided with a system of refrigeration pipes so that the temperature can be kept low enough to prevent the growth of the germs that are always present, even in the best of eggs. The cups into which eggs are broken, and all other utensils, such as cans, etc., that come in contact with the egg meat, show a smooth surface.

The girls who break the eggs are required to be neat and have clean hands. As each egg is broken into a glass cup, the girl smells it, and if she detects an odor, the egg is discarded. There is a large demand for egg-preparations consisting of white or yolk alone, or in various proportions. Therefore, the white is separated from the yolk by means of a simple mechanical device which insures



Roads around New National Museum, Washington, D. C. Constructed with "Tarvia X".

This road is three years old—

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Tarvia is made in three grades: "Tarvia X" is suitable for building Tarvia—macadam roads; "Tarvia A" and "Tarvia B" are thinner grades suitable for roads already in use, to preserve them and make them dustless.

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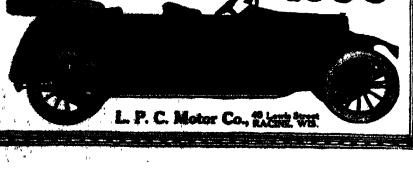
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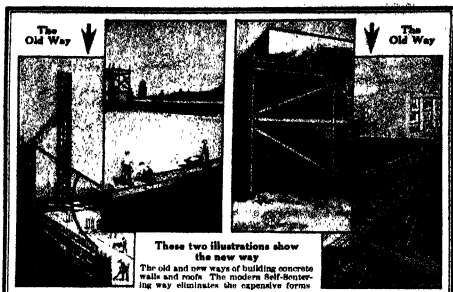
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In every stage in building construction the use of Self-Sentering not only cuts down costs and saves time but results in better work. Its use is a short cut to better and more economical permanent construction.

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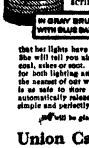
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cleanliness. Dirty eggs are not fit for this work because during separation there is too much danger of contamination with bacteria and foeal matter from the shells. The mere fact that the white and yolk can be separated is a proof of the good quality, because a weak yolk is one of the earliest signs of decomposition, and such an egg cannot be broken without getting the yolk and the white mixed.

The egg meat is transferred to a large, closed mechanical churn provided with a brine cooling jacket, and is thoroughly churned for about half an hour. To make the frozen product, the churned egg-meat is distributed into 50-pound cans, which have first been sterilised in live steam. The cans are immediately transferred to a refrigerator, where the contents are frozen solid in a short time, at a temperature of several degrees below zero. Here they are kept until they are shipped in refrigerated cars to hotels, restaurants, bakers, and dealers.

The egg meat intended for conversion into the dry product, is taken to the drying room as soon as possible after leaving the churn. The drying apparatus consists principally of a long flexible metal belt, which revolves in a hot air chamber, around two big drums. The strong air current applied in drying is filtered and heated by steam coils before coming into contact with the egg meat. The temperature of the air is regulated automatically so that it will never reach a point at which it might coagulate the egg and render it insoluble. Of course, the egg meat never gets as hot as the surrounding air, because it rapidly loses water through evaporation, and this evaporation reduces the temperature. At one end of the hot air chamber the belt is exposed for a short distance, and here the egg mixture runs upon the belt along its whole width, in a continuous stream. The egg meat is supplied by gravity from a large cooled cylindrical tank, which is suspended several feet above the outlet.

The belt makes one complete revolution in 15 minutes. This is sufficient to dry the thin layer of egg, and not long enough to permit a multiplication of the bacteria in it, as it takes the bacteria at least half an hour to divide by fission. As the egg meat is applied to the belt in a continual stream, several layers of egg are superimposed upon each other. When the whole layer of dried egg has reached the desired thickness, the further application of egg is stopped and the thin film of dried egg is scraped off the belt by a mechanical steel scraper. The resulting dry egg is now in the form of fine golden-yellow flakes, which are placed on sieve-trays of various mesh size and exposed to a current of dry-heated air, in a special room. Here the drying process is completed. The finished product, which contains only about 5 per cent moisture, can be kept in cold-storage indefinitely without deteriorating. At room temperature it changes slowly, finally acquiring a fishy odor and losing its solubility.

The conversion of eggs into the frozen and desiccated product should become a great stimulus to the egg industry of this country. In fact, it opens up the European market to the American egg. The cold-storage of eggs only retards, but does not prevent deterioration. With the modern methods of freezing and desiccating eggs, on the other hand, it is possible to obtain a product which retains for a long period the qualities of fresh eggs.

Desiccating also greatly reduces the weight and bulk of the eggs, one pound of the dry product representing about 8½ pounds of the raw egg-meat obtained from 30 eggs. This means an enormous saving in freight and storage charges. When it is remembered that the high price of eggs in our large cities is chiefly due to the high cost of transportation and storage of the bulky shell eggs, and to the great losses arising from their decay and breakage during transit, the value of the freezing and desiccating industries will be appreciated.

In spite of all these advantages, savings and conveniences that the use of frozen and desiccated egg offers, there seems to be quite a popular prejudice

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against it. This is due partly to the fact that a few dealers have placed on the market, or sold clandestinely for food purposes, frozen and desiccated rotten eggs. A large amount of eggs that are unfit for food are worked up into so-called "tanners' eggs," to be used in the treatment of fine leathers. In the preparation of tanners' eggs, the sound portion of spot eggs, eggs showing bloodrings, and tainted eggs are used. After desiccation the product can hardly be distinguished by its physical appearance, from a similar preparation obtained from perfectly good eggs. It has been found in a few large Eastern cities that eggs which were supposedly sold to tanners were bought by unscrupulous dealers, deodorized by a trace of formaldehyde, and sold for food purposes with great profits. After such eggs are sold to tanners, it is very hard to keep track of them and they may, in a roundabout way, make their appearance in cheap restaurants and bakeries. Denaturation of such preparations at the factory is the only sure way to prevent their use as food. It is easily possible to find a substance which, when added to tanners' eggs, serves as a telltale without exerting a bad effect upon the leather.

Planting Hair on Bald Heads

(Concluded from page 83.)

the scalp is pierced and the hair planted The instrument is power-driven, the power being transmitted through a flexible shaft *A*. The hair, after being sterilized and otherwise treated to make it as stable as possible, is inserted in a long glass tube *B*, and is fed to the needle by a friction wheel that is concealed in the drawing by the ratchet wheel *C*. As indicated in the detail views, first the needle *D* is fed forward by a crank motion, to puncture the scalp; then the two points of the needle spread open, while the hair, which has been following the needle, is fed into the puncture; thereupon the needle is withdrawn, and a cutter chops off the hair to the desired length. An adjustable plate *E* forms a spacer between the end of the instrument and the scalp, to regulate the depth of the puncture, because scalps of different individuals vary according to their age and general condition of health.

Pending Applications in the Patent Office and How They Are Being Handled

THE Commissioner of Patents has caused a count to be made of all of the applications pending before the Patent Office at the close of business on June 30th, 1914.

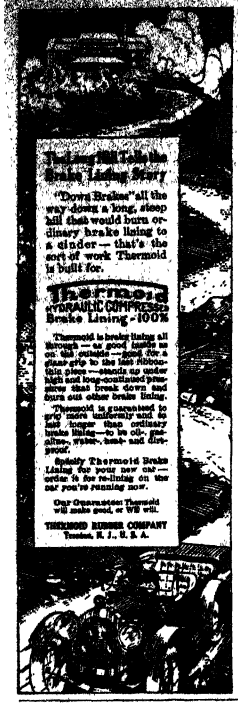
The applications may be divided into two classes, namely: First, those which have been finally passed upon by the Office, or in technical language, have been "allowed"; these await the payment of the final fee before the patents are granted; and second, those which have not been finally passed on or allowed.

The count shows the number of applications allowed to be 22,623, and the number not allowed to be 116,832. The total number of applications in the Office is 139,455.

Referring now to the 116,832 applications not yet disposed of, the count has been made as to how long these applications have been pending. The count shows:

The number pending over 15 years. 52
The number pending over 10 years. 241
The number pending over 5 years. 4,231
The number pending over 2 years. 31,677

The number of applications pending over two years includes, of course, all of those enumerated as pending for five, ten, or fifteen years. This count shows, therefore, that in order to limit the prosecution of applications in the office to two years, as the Commissioner is endeavoring to do, it is necessary to dispose of 31,677 applications which have been pending for a longer time, and to prevent any of the remaining 87,155 applications which have been pending less than two years from exceeding the two-year limit. It will, there-



"Why don't manufacturers put better paint on machinery?"

Put yourself in the buyer's place.

If you bought a machine on which the finish cracked or checked with age, that blistered when subjected to heat, or became spotted and unsightly when in contact with lubricating oils and grease—you'd join the multitude of owners of machines of almost every conceivable kind and ask the oft-heard question in the heading.

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You can depend upon them to yield a result entirely unlike the service for which they are intended. No matter what you paint—whether it be structural steel, or smoothest polished very fine finishing wood—you can paint with a finish that will wear well; look well, and be economical to use, too.

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Lapidolith, a liquid chemical, takes the dust and crumble out of all concrete floors

It puts in wear and long life.

No skilled labor required—not costly to put on—just flush evenly—then hard, dustless wear for years.

If you have learned that surface paint, wax or oil wears off quickly—then you are ready to use Lapidolith and forget your concrete troubles.

Lapidolith changes the free lime into a granite-like mineral and binds the particles into a fine-grained, wear-proof mass.

Lapidolith causes a positive chemical change in concrete, and its effect is therefore permanent.

Use Lapidolith on your old concrete floors It will positively stop their dusting and crumbling and make them better than when new. New concrete floors without Lapidolith are only half finished.

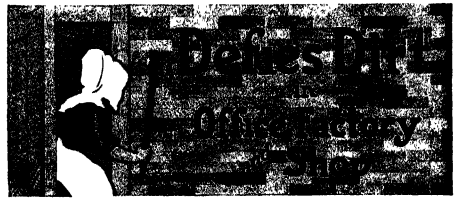
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fore, be clear that the problem involves attention to perhaps 30,000 or 40,000 applications.

The Commissioner finds it impossible to press this work, and believes that the progress which he is making is gratifying. A count shows that during the first six months of this year, namely, to June 30th, the number of applications allowed exceeded the number allowed during the first half of last year by 7,979.

These allowances, of course, mean increase in the number of patents granted, and it is mainly this that has given rise to the increase in the surplus referred to, for the cost of printing a patent is considerably less than the final fee charged upon the granting of a patent.

The foregoing figures will indicate that if the policy of reducing the time during which applications are pending in the Office to two years is pressed, the surplus will be still more largely increased, and will be maintained during the number of years necessary to work off the accumulation of the old applications.

The investigation confirms the opinion expressed in the last annual report of the Commissioner that the great bulk of the applications should be disposed of within two years The considerations which bear upon this problem are numerous, and the problem of fixing a reasonable maximum is not free from difficulty. From the viewpoint of the Office, the main consideration is that the time should not be made so short as to require special attention by the Office to applications which will ultimately be abandoned.

Only about 50 per cent of the applications filed each year eventually become patents. For example, during the past two years 71,301 patents have been granted and 137,297 applications have been filed. The difference of about 66,000 applications represents substantially the number of applications filed and abandoned during those two years. That is to say, there are about 33,000 a year. Any order or policy which would require special attention to these 33,000 applications involves waste of time which should be devoted to the applications ultimately eventuating in patents.

The Commissioner endeavored to ascertain the average life of the abandoned applications, and finds it to be about twenty-eight months In order to arrive at this figure he has had made an accurate count of the time during which all applications which eventuated in patents during the first half of this year were pending, and he finds the average time to be 21½ months. As there are substantially two years accumulation of cases in the Office, and therefore the average length of life of all those which are pending must be two years, and as about 48½ per cent of the applications filed become abandoned, it follows that the average life of the abandoned applications must be somewhat more than six months in excess of that of the applications which eventuate in patents, making them as indicated, about twenty-eight months.

Abandonment, however, occurs only as the result of a year of entire inactivity in the applications. Therefore, the average active life of the abandoned applications is one and one third years, and in two years the great bulk of them would be out of the way. This seems to be a good reason for making no special rules respecting applications pending not more than two years. Beside this, the Commissioner's own experience satisfies him that two years' time is very frequently honestly required and that a shorter period would be a hardship.

Hence the Commissioner has selected this as the maximum limit of normal prosecution. After the thirty-one thousand and odd applications which have been pending more than that time have been worked off, he thinks it will be appropriate to make a rule that all applications pending in the Office for more than two years shall be brought to the special attention of the Commissioner. It must, however, be evident that it is impossible for the Commissioner to give the personal attention to all of the applications pending over two years.

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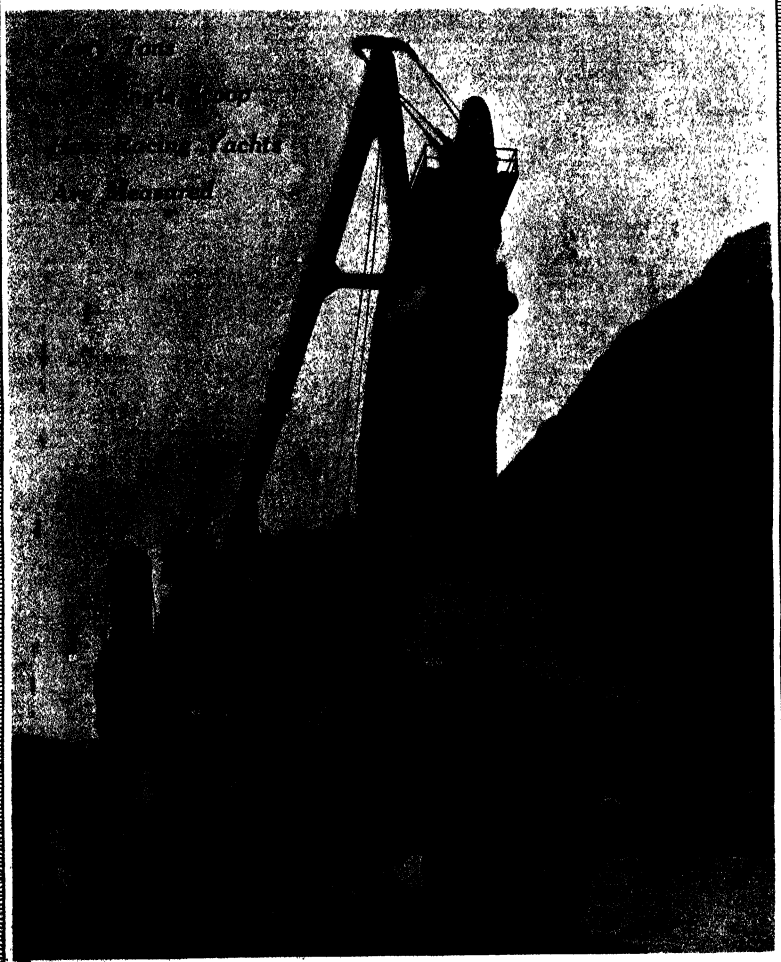
ENGINES





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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Cape Cod Canal in Service

WHEN Nature shaped out the promontory of Cape Cod, she did so in such fashion as to suggest, from the very first days of colonial occupation, the advisability of circumventing that serious obstacle to safe navigation by cutting through the narrow neck which joins Cape Cod to the mainland. For it is a fact that the first serious mention of canal cutting dates from early colonial days; and in the intervening centuries, at intervals, the project has received the serious attention of the engineer, the shipping man, and the State and Federal authorities

The perils of Martha's Vineyard, Nantucket Sound and the western shore of Cape Cod, have constituted a serious menace to the ever-increasing coastwise traffic between the southern and northern ports of the Atlantic seaboard. Shipping that has worked its way to the eastward under the friendly shelter of Long Island, and in the comparatively smooth waters of Long Island Sound, has been confronted by the fog and heavy currents of Nantucket Sound, and by the danger of being caught by Atlantic gales upon the harborless stretch of a lee shore on Cape Cod. That the perils of this part of the coastwise passage have been very real is proved by the estimate of shipping men that, during the last three quarters of a century, over 2,000 ships and about 700 lives have been lost in the perilous passage around the Cape.

The opening of the Cape Cod Canal on July 29th has changed all this; and the security which will be afforded by the new waterway and the reduction in the cost of transportation, can be appreciated only by those shipping men and mariners who have been familiar with the cost and risks of the old outside passage

Cape Cod Canal has been cut through an eight-mile strip of land which intervened between Barnstable Bay and Buzzards Bay. The interests which have now completed the work, in 1899 took up the task where it had been abandoned by previous companies. The building of the canal has presented no engineering problem of difficulty, and the work has consisted of straightforward excavation through sand, interspersed in certain portions of the route with boulders The work has been done at sea level, and it has involved the removal of about 20,000,000 cubic yards of sand and earth. The highest point cut through had an elevation of only 29 feet, and the work was facilitated by the fact that much of the work lay below sea level. Although the canal is only eight miles in length from entrance to entrance on the shore line, it continues with a 30-foot depth in Buzzards Bay and Barnstable Bay by extensions which makes the actual length of the channel twelve and one half miles The minimum width at the bottom is 100 feet and at the surface 250 feet

The commercial utility of the canal will be appreciated, when it is stated that the average delay per round trip yearly for barges and schooners over the outside route is nearly four days, which is equivalent to a loss of 10 cents per ton on the 7,000,000 tons of coal and lumber carried in these craft alone Add to this that the total amount of coal and lumber carried by steamers is 4,500,000, on which an equal saving per ton will be realized, and it will be seen that, in spite of its short length, this canal will carry in its first year of operation an amount of tonnage equal to, if not greater than, that which it is estimated will seek the Panama Canal in the first year of service of that great work.

Navy Personnel Legislation

FOLLOWING the statement of Rear Admiral Knight, a member of the 1914 Plucking Board, that the recent "pluckings" of five captains from the naval service has added not one iota to the efficiency of the navy, and that these men were plucked because of an act of Congress which forced this unwelcome duty upon the pluckers, Congressman Fred A. Britten, a member of the Committee on Naval Affairs, recently introduced in the House a bill providing for the total elimination of the Plucking Board and the retirement of naval officers by themselves through a series of examinations.

In speaking of his bill, the Congressman said that the great criticism heaped upon the last Plucking Board for retiring such able officers as Captains Hill and Gibbons, who in themselves are the equal in efficiency to most rear admirals still in the service, is but another evidence of why the law of 1899, providing for the "Plucking Board," should be repealed and some form of legislation substituted which would insure the same number of retirements as now provided by law.

Mr. Britten's bill provides for placing the navy personnel on a Civil Service basis, requiring mental and physical examinations for promotions from the grade of ensign up to and including the grade of rear admiral. Examinations will be held by the Navy Examining Board, and final markings are to be based on the official service record of the officer, which is given a weight of 60 per cent, and on a mental and physical examination, which is given a weight of 40 per cent out of a total of 100.

Failure to pass an examination will cause the candidate to be registered in the next lowest academy class and a second failure will cause the retirement of the officer, who may be retained in a special service at the discretion of the Secretary of the Navy at three quarters pay of the rank he occupied at retirement, and in which service he may advance by promotion to the rank of commander.

We are in hearty sympathy with this bill; but we would suggest that it would be more sure of accomplishing its purpose, if the markings and percentages were rearranged so as to include a vote by the officers themselves on the efficiency of the candidates for promotion. This suggestion, which originated among the personnel, contemplates having the officers of each grade pass upon the efficiency of the candidates in the grade below The intimate knowledge of each others' abilities which obtains among naval officers would render such estimates of great value; and they should be incorporated in the official record and the mental and physical markings, as proposed by this bill.

The Kaleidoscopic Plans of an Exploring Expedition

IN September, 1913, it was announced from England that Mr. J. Foster Stackhouse was organizing an expedition for the purpose of exploring King Edward VII Land, in the Antarctic. This announcement came at an auspicious moment, as the enthusiasm which it evoked was, in part, a *contre-coup* to the painful impression produced by the then recent disaster to the Scott expedition. The promoter of the new enterprise made rather free use of Scott's name in connection with his undertaking, announcing that Scott had approved its plans, and pointing out that the exploration of King Edward VII Land had been an unfulfilled part of the programme of the British Antarctic Expedition of 1910-13. His effort to establish a connection between his expedition and Scott's was, however, repudiated by Commanders Pennell, Evans and Campbell, and other members of the expedition of 1910-13.

In the course of a few weeks the plans of the expedition underwent considerable alteration. Early in November it was stated that the explorers would not sail directly to King Edward VII Land, but would first explore the coast between this region and Graham Land, beginning at the latter. Further announcements indicated that the exploration of this unknown coastline had become the principal purpose of the expedition. In February of this year a detailed programme was announced, including the landing of a party on the east side of Graham Land, and three years of cruising and exploration along the coast as far west as McMurdo Sound; but apparently no exploring in the interior of King Edward VII Land. Last April the sailing date of the expedition was postponed to the end of the present year or the beginning of next.

A few weeks ago press dispatches brought the surprising information that Mr. Stackhouse and his party expected to sail in December, 1914, not for the Antarctic, but for Iceland, and to spend seven years in miscellaneous oceanographical research more or less all over the world. The enterprise, it appears, is now known as the British Antarctic and Oceanographical Expedition, but Antarctic exploration occupies only a minor place in the programme. According to a circular letter issued by the leader, the expedition proposes (1) to investigate reports of mariners as to the existence of dangerous uncharted rocks, shoals, reefs, islands, etc., on the trade routes of the world; (2) to discover the extent and position of the coast line still unmapped on the continent of Antarctica; and (3) to make a scientific survey of the sea in general.

Finally, the New York *Times* of July 26th informs us that "Commander" Stackhouse has accepted an important post in connection with the arrangements for next year's proposed aeroplane race around the world, and will undertake the laying of caches and the erection of landmarks on the coast of Greenland for the benefit of the contestants. From all of which it appears that the gentleman in question is exceedingly anxious to quit the shores of Albion, but is not at all particular about his destination.

Observations on Finishing Temperatures and Properties of Rails

THE main objects of the investigation recently completed by the Bureau of Standards, Department of Commerce, into the finishing temperatures and properties of rails were to determine, from measurements taken in representative rail mills, the present American practice regarding the temperatures at which rails are rolled; to demonstrate the ease and accuracy with which such temperatures may be measured; to find out what the "shrinkage clause" in rail specifications really means; and finally, to determine for rail steels some of the physical properties, particularly those of interest in manufacture.

Observations were taken with an optical pyrometer of ingot and finishing temperatures of rails in four representative mills. There is practical uniformity among the several mills for the rolling temperatures of ingots for steel rails, the range being from 1,080 deg. Cent. (1,975 deg. Fahr.) to 1,140 deg. Cent. (2,085 deg Fahr.). There is no very considerable difference among the finishing temperatures of the rails as observed at the hot saws for the several mills, the range being about 880 deg. Cent. (1,615 deg. Fahr.) to 920 deg. Cent. (1,515 deg. Fahr.). Or, in other words, the four mills all finished their rails to within 50 deg. Cent. of 935 deg. Cent. (1,715 deg. Fahr.) on the average. This temperature of 935 deg. Cent. is 270 deg. Cent. (520 deg. Fahr.) above the mean value, 665 deg. Cent. (1,230 deg. Fahr.) of the critical ranges of these rail steels. Concerning the distribution of temperatures within the head of a cooling rail, it is shown that the center of the head is some 50 deg. Cent. (120 deg. Fahr.) to 60 deg. Cent. hotter than the optical pyrometer reading at 935 deg. Cent., therefore the center of the head is finished, on the average, at about 825 deg. Cent. (615 deg. Fahr.) above the critical range for 100-pound sections.

The following thermal properties of sample rail steels were determined in the laboratory:

The critical range or heating is located (maximum) to within 70 deg. Cent. of 732 deg. Cent. (1,350 deg. Fahr.) for the ten samples of Open Hearth and Bessemer steels examined. On cooling the critical range lies between the limits 680 deg. Cent. (1,256 deg. Fahr.) and 650 deg. Cent. (1,202 deg. Fahr.).

The melting or freezing range for rail steel extends from about 1,470 deg. Cent. (2,680 deg. Fahr.) to nearly the melting point of iron, located at 1,530 deg. Cent. (2,786 deg. Fahr.).

The expansion of Open Hearth and Bessemer steels is not the same. Above 800 deg. Cent. (1,470 deg. Fahr.) the expansion for both increases linearly with temperature and the linear coefficient per degree Centigrade has the following mean values between 0 deg. and 1,000 deg. Cent.:

(1) For Bessemer steel (carbon 0.40 to 0.50 per cent): alpha = 0.0000146.

(2) For Open Hearth steel (carbon 0.65 to 0.70 per cent): alpha = 0.0000156 to 0.0000161.

The average composition of the Bessemers was carbon = 0.40 to 0.50 and manganese = 0.76 to 0.93; of the open hearth, carbon = 0.66 to 0.70 and manganese = 0.86 to 0.72.

The American Society for Testing Materials in 1909 limited the shrinkage allowance on 100-pound sections to 6¾ inches in 33 feet, or to an equivalent of 1,947 deg. Fahr. (1,084 deg. Cent.) for Open Hearth, and 2,055 deg. Fahr. (1,134 deg. Cent.) for Bessemer rails. This specification is still in force. Such a shrinkage clause, therefore, does not serve the avowed purpose of limiting the finishing temperatures to a value slightly above the critical range.

In conclusion, it should be emphasized that the various series of observations recorded in this investigation are of but a preliminary nature and do not pretend to solve the question of the relations between temperature of rolling and the properties of rails. It would seem desirable to make a much more complete and comprehensive study of the various matters mentioned and of related questions than has hitherto been attempted, and on a scale commensurate with the importance to the community of the problem of sound rails.

Engineering

Battleships as Targets.—The Navy Department is considering the question of using our obsolete battleships of the time of the Civil War as targets for big-gun practice. The results obtained by the navy for some years past in shooting at the old Texas have been so valuable that it is realized the data obtained from firing at the Iowa, Massachusetts or Indiana, would be of far more value to the Navy than any sum that could be realized from the sale of these vessels as junk.

Driving the Longest Tunnel in America.—At present the longest tunnel in America is the Hoosac tunnel, at North Adams, Mass., which is four and three quarters miles in length; but there is now being constructed on the Rocky Mountain Division of the Canadian Pacific Railroad, what is known as the Roger Pass Tunnel, which will be five miles in length. It will cost over $10,000,000. The highest point reached by the tunnel will be 3,795 feet above sea level, or 4,065 feet below the extreme top of the mountain. The tunnel will have a rising grade of one per cent to its interior summit.

Zinc Ore Plant in North Africa.—The use of hydraulic power in Kabylia is quite rare, so that we may cite the new plant for the use of the Gergur zinc mines which he about 60 miles from the coast. In order to secure power for operating electric motors at the ore-washing plant, the engineers decided to erect a hydraulic plant at Kef-el-Afas, where the bed of the Ben Sellam runs between rock walls and a barrage could be readily built across the gorge. This backs up a lake of some miles length. The electric station lies adjacent to the barrage, and contains a Francis turbine coupled to a 150 horse-power alternator of 3-phase 3,000 volt type. A power line takes current for a few miles to the zinc plant.

Large Egyptian Pumping Plant.—One of the largest pumping installations in the world is being built by the Egyptian government to drain Lake Mareotis, near Alexandria. It will consist of eighteen enormous pumps of the Humphrey type, which has already been described in the SCIENTIFIC AMERICAN. Each pump is 8 feet 8 inches in diameter, and is capable of delivering 100,000,000 gallons per day through a lift of twenty feet. The maximum internal diameter of the combustion chamber will be 8 feet 8 inches, and its height 14 feet. The water valve box will be 8 feet 8 inches in diameter and 7 feet high, and it will be fitted with 100 valves of the hinge type, specially designed to enable any valve to close upon an obstruction, without throwing undue strain on the hinges.

Mosaics upon Reinforced Concrete.—At an earlier time, reinforced concrete was made to imitate stone construction to a large extent, but at a later stage architects commenced to use forms which were adapted to the nature of the material, which is of course only logical. The same applies to the question of ornament upon reinforced concrete, and while molded relief can be very well used, it is found that the flat surfaces are also well adapted to receive colored tile decoration, with very good effect. More recently, a mosaic decoration is coming into use, for the concrete most naturally lends itself to imbedding of mosaic directly in the material, and this can be done with very little trouble. This method is beginning to be employed in France for house trimmings, and the bright colors of the mosaics add considerably to the otherwise rather dull hue of the cement.

Protecting Oil Tanks Against Fire.—There was recently tested satisfactorily at the Standard Oil Works in Bayonne, New Jersey, a device for automatic extinguishing of fire. The tank of 50,000 gallons capacity was nearly filled with water, on the surface of which was a layer of Mexican crude oil, five inches deep. Above this two buckets of gasoline were suspended to assist ignition. From the time the oil was fully ablaze until the time of extinction of the fire, was only nine seconds. The principle consists in producing large volumes of carbon dioxide by the automatic mixing of the proper ingredients, which are contained in four upright tubes attached to the tank. The contents of the tubes are held in position by fusible wires, which, when the temperature reaches a certain point, are fused, permitting the constituent substances in the tubes to mingle and produce large volumes of the carbon dioxide.

Last Year's Gunnery and Engineering Work.—The Secretary of the Navy has sent letters of commendation to the officers who commanded the vessels which won the gunnery and engineering trophies for the last year. These were as follows: Capt. J. H. Glennon, U. S. S. "Wyoming," gunnery trophy in the battleship class; Capt. W. R. Fletcher, U. S. S. "Kansas," winner of the battleship engineering trophy; Lieut.-Commander Arthur Crenshaw, U. S. S. "Cummings," battle-efficiency pennant in the torpedo boat destroyer class; Lieut.-Commander W. N. Jeffers, U. S. S. "Fanning," gunnery trophy destroyer class; Lieut.-Commander C. P. Hutchins, U. S. S. "Seals," engineering trophy, destroyer class; Commander R. H. Leigh, U. S. S. "Galveston," gunnery trophy, cruiser class; Commander J. K. Robinson, U. S. S. "Dixie," gunnery trophy, gunboat class; Lieut. Luther Welsh, U. S. S. "Paul" winner of gunnery trophy in the submarine class.

Science

A Geological Manual for Exposition Visitors.—For the benefit of visitors to the Panama Exposition at San Francisco, the U. S. Geological Survey is preparing to publish a bulletin on the geology and other physiographic features of a strip of land about 25 miles wide along the Santa Fé Railway from Kansas City to Los Angeles. It will include geological and topographic maps on a scale of 1:500,000, while the text will give an account of notable scenic features, Indians, history, and local industries.

An Index to Seismological Literature.—During the period of 1841–1912, the British Association published 53 annual reports and other notices about seismology and other branches of geophysics, constituting, in the aggregate, an immense body of varied and valuable information. In order to make all this material easy of access, the late Prof. Milne prepared a subject-index to it, and included in the same index references to a number of notes and papers in the "Transactions of the Seismological Society of Japan" and the *Seismological Journal*. This index is published in the Report of the British Association for 1913, just issued.

Biological Tests of Honey are described by J. Thönt in the *Schweizerische Bienen-Zeitung*. Such tests are necessary for detecting artificial or adulterated honey, when the natural product is almost perfectly imitated as to its physical and chemical properties. Two tests are described in detail, viz., the diastase reaction, based on the fact that honey contains a diastatic ferment secreted by the bee, which, in contact with soluble starch, is capable of transforming the latter into sugar, and the precipitin reaction, based on the fact that honey contains a special protein secreted by the bee, which, when inoculated into rabbits, causes the formation of antibodies in the blood serum; these antibodies, when mixed with the honey under examination, yield a precipitate, and the quantity of this precipitate indicates the kind and amount of the adulteration.

Lead Derived from Radium.—A very interesting paper by K. Fajans on the different atomic weights of lead was read before the Bunsen Gesellschaft für angewandte physikalische Chemie at Leipzig. According to a line of reasoning, simultaneously developed by Fajans and Soddy during the last few years, lead derived from radium and lead derived from thorium by the loss of five and six atoms of helium respectively should be identical, except in atomic weight. Throughout the past year, Dr. Fajans' assistant, Dr. Lembert, has been working in Richard's laboratory at Harvard, in order to obtain atomic weights of as high a degree of trustworthiness as possible. The differences established by the series of determinations announced at the meeting by Fajans amount to about 0.3 per cent. In this connection, it is interesting to note that Soddy and Hymans read a paper before the London Chemical Society on May 7th, in which they likewise described experiments which showed a difference between thorite lead and ordinary lead of 0.5 per cent.

A Tabloid Course in Forestry is offered this year, for the second time, by the New York College of Forestry at Syracuse, in the shape of a summer forest camp in the Adirondacks during the month of August. The purpose of the camp is two-fold, viz., to give such elementary training in forestry as will indicate in a way to prospective forestry students just what the practice of forestry means; and to give men who love an out-of-door life an opportunity to learn something about the forest, its trees, shrubs, and animal inhabitants. The camp is located this year on Hoel Pond, just north of Upper Saranac Lake, and is open to youths and men of over 15 years of age, who are in good physical condition. There are from two to five instructors constantly in camp. A course of daily lectures on plant relationships, with field trips; a ten day course on forest zoology; a week's course on the fungi of the forest; and a week's course in woodcraft by a veteran Adirondack guide are on the programme for this summer.

A Japanese Scientific Journal.—There is an interesting review in *Nature* of the March issue of *Genda no Kagaku* (*Scientific Gazette*)—a new Japanese journal similar to *Nature*, printed in Japanese characters. It has been designed to meet an increasingly felt need for a serious and authoritative general organ for the growing body of men of science and students of research in Japan. The journal is well printed, and its contents are written and edited by professors of the Tokyo and Kyoto Imperial Universities. The issue in question contains special articles on insects and their pupæ, the relation between zoology and medicine, great men of science, and inertia and relativity; reviews of books; notes and abstracts classified under the various sections of astronomy, physical geography, biology, chemistry, and applied sciences; meteorological reports and ephemerides of celestial phenomena, and proceedings of societies. In the last named section no fewer than eight learned societies of Tokyo are represented. The illustrations include a collotype portrait of Prof. Simon Newcomb, and a star chart, to be continued serially. The publication is to be welcomed as a sign of the increase of interest in scientific subjects in Japan.

Automobile

Turning the Head-light from the Steering Gear.—A head-light which may be coupled with the steering mechanism so it will be automatically shifted with the movements of the front wheel of the automobile is shown in patent No. 1,100,946, to John J. Bobbie, Pekin, N. D.

Regulating and Recording Automobile Speed. In a patent, No. 1,100,254, Abel Raimond Alexandre Gerard de Recondo, Paris, France, presents an apparatus to regulate the speed of motor cars and to record the excess of speed in case the determined speed is exceeded.

An Automobile Tire Pump Driven from Air Pump.—Charles N. Celstad, of Atlantic, Mass., in a patent, No. 1,100,056, drives the tire pump from the fan-driving mechanism, the tire pump being associated with the fan-supporting bracket.

Road Mirrors for Motorists, placed at dangerous turns or junctions of streets and roads, have found their way to India. The American consul at Bombay reports that the largest of these devices heretofore installed anywhere in the world is to be placed at a street corner in that city. Its size will be 10 feet by 5, as contrasted with 2½ by 3 feet, the customary size in England.

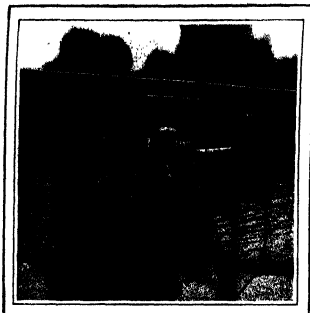
A Powerful Portable Wireless Outfit.—The Signal Corps of the United States Army has just taken delivery of what is probably the most powerful portable wireless telegraphy outfit of its kind. The apparatus is mounted on a motor car chassis and can be set up complete and in operating condition in as short a time as 12 minutes. Under favorable conditions, the apparatus has a sending radius of up to 800 miles. Messages from points 2,500 miles distant have been received. The generator which furnishes the current is driven by the same motor that propels the vehicle. Antenna of the umbrella type are used, the mast, which is in nine sections, being 85 feet in height.

An Omnibus Company's Interpreters.—The proprietors of the London General Omnibus Company, which operates the majority of the 'buses that ply the streets of London, have taken a novel means to increase the number of passengers carried. A dozen men speaking several languages will be stationed at as many busy centers so that foreigners may have no difficulty in choosing a 'bus for their proper destination. Already the company has established a school where the men are trained. They will be taught French, German, Russian, Danish, Spanish, Norwegian, Polish and Arabic, will wear a special uniform and display a badge, making plain the languages they are prepared to give information in.

Synthetic Motor Fuel Possibilities.—The synthetic production of gasoline, or rather motor fuel, is not unknown, though heretofore its production has been little more than a laboratory experiment. A few weeks ago, however, a Portuguese-American chemist claims to have succeeded in producing a quantity of motor fuel which was tested on the Indianapolis Speedway with good results. The inventor uses naphthaline, the white powder of which moth balls are made, and water, in combination with another ingredient, the name of which has not been divulged. The three are run through an ordinary still. The liquid produced closely resembles gasoline and has a Baumé test of 64 degrees. A large six-cylinder car ran 12.5 miles on one gallon of the fuel. With gasoline, the same car ran 17.5 miles an hour. The inventor claims that the new fuel can be produced in commercial quantities cheaply.

Block Testing of Motors with City Gas.—The cost of gasoline is comparatively high, and, by way of reducing factory overhead, a number of Detroit makers lately have taken to testing their motors with city gas instead of with gasoline. It has been found that an economy of as much as $80 a day can be effected by some makers. It has been found that the city gas at 45 cents per 1,000 feet is cheaper for the purpose than gasoline at 9 cents a gallon. A comparison of costs reveals that an engine developing 19.04 horse-power consumes 458 feet of gas which costs 20.61 cents an hour, while 2.24 gallons of gasoline would be required to develop the same power, and the cost would be 33.6 cents an hour with gasoline costing 15 cents a gallon. On one test, it was proven that the cost of city gas works out at 58 per cent of the cost of gasoline.

Carbon Deposit and the Sleeve-Valve Motor.—Far from being detrimental to the operation of the sleeve-valve motor, carbon, according to the statement of Chas. Y. Knight himself, actually is of benefit. Knight explains this seeming incongruity by stating that the carbon deposit assists in closing minute interstices in sleeves and walls, and thereby prevents leaks and helps maintain the compression pressure. Furthermore, he sounds a note of warning regarding the indiscriminate removal of carbon deposits from Knight motors and states that sharp-edged tools should not be used for the purpose. Instead, he advocates the use of rough fabric which will carry away such loose particles as might cause pre-ignition and leave the heavier deposit with its glossy surface in place. He attributes the formation of carbon rather to the poor quality of fuel and to its incomplete combustion than to road dust and the burning of lubricating oil.

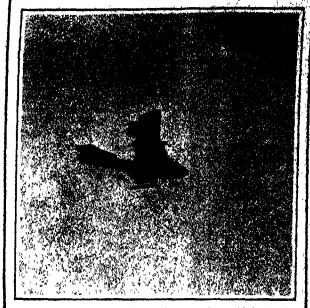


Commandant Barres and Lawrence Sperry at the conclusion of a flight.

The Sperry Gyroscopic Stabilizer

How It is Constructed, How It Operates, and How It Demonstrated Its Capabilities During an Interesting Test in France

By John Jay Ide, Paris Aeronautic Correspondent of the Scientific American



Test of Sperry stabilizer, Bezons, June 18th, 1914. Pilot standing up in seat and passenger 6 feet out on right plane.

A DESCRIPTION of the Sperry stabilizer for aeroplanes was given in the SCIENTIFIC AMERICAN for June 7th, 1913. Although the principle of operation remains the same, a number of changes in the construction have been made since that date. The stabilizer is now fitted to a Curtiss flying-boat instead of to the old type hydro-aeroplane of the same make.

The apparatus proper consists of a group of four gyroscopes arranged in two pairs. The gyroscopes forming a pair revolve in opposite directions in order to neutralize precessional movement. One pair turns in the plane of symmetry of the aeroplane, and the other in the vertical plane parallel to the span. The group is contained in a sort of cage composed of two rings, one horizontal and the other vertical. The cage being universally jointed can oscillate around its lateral and longitudinal axes. Attached to the rings are levers acting on the valves of two compressed air servo-motors, placed near the gyroscopes, controlling the elevator and ailerons. In normal flight the gyroscopes keep the axes of the rings strictly horizontal and vertical so that the slightest tipping of the aeroplane in any direction is instantly corrected through the servo-motors.

An essential part of the Sperry apparatus is the anemometer mounted on the right forward engine strut. As Mr. Sherrett states in the article referred to above, the anemometer accomplishes three functions. In the first place it furnishes the pilot with a visible record of his speed at any moment. Secondly, it prevents the machine from rising so steeply that there is danger of its falling back on its tail. When the aeroplane approaches the critical angle, the loss of wind pressure on the rectangular disk causes the anemometer, by means of the servo-motor, to block the longitudinal control lever as regards further climbing by shifting its fulcrum. The aeroplane is then automatically started on a gliding descent which is continued until the normal flying speed is regained.

Finally, the anemometer regulates the action of the gyroscopes in turning. A certain angle of the aeroplane relative to the plane of the gyroscopes entails a corresponding opening of the valve of the servo-motor, and consequently a corresponding angle of the ailerons or elevators as the case may be. As this angle depends upon the inclination of the aeroplane and not on its speed, the effect would vary greatly according to the velocity of the machine. A certain angle which would be suitable for low speeds would be much too great if the speed were high, and might even throw the pilot out of his seat. The anemometer by changing the fulcrums of the levers controlling the valves of the servo-motors according to the wind pressure on its face insures that the corrective efforts of the ailerons and elevators are proportionate to the speed.

The electricity necessary for the gyroscopes, which weigh only two pounds each and turn at 12,000 revolutions per minute, is obtained from an alternating current dynamo run from the front end of the motor by a belt. It is claimed that in case of stoppage of the motor the gyroscopes would continue revolving for half an hour. A battery, however, is carried as a reserve. A regulator, seen in one of the photographs in front and to the left of the apparatus, controls the current used by the gyroscopes. As the current is alternating, a wireless installation can be fitted with very little extra weight.

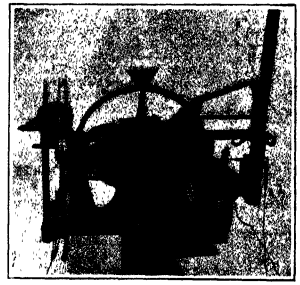
Compressed air is obtained from the motor and stored in a tank in a similar manner to that employed in compressed air self-starters for automobiles. The tank is of sufficient capacity to supply the servo-motors for a short period after the stoppage of the engine. To get up pressure, however, the motor has to be run for a short period before a flight and leakage is impossible to obviate entirely. In the stabilizers now under construction electric servo-motors are employed. The total weight of the apparatus is about 45 pounds.

Both lateral and longitudinal controls can be thrown in and out of action at the will of the pilot by means of a pedal. When the stabilizer is in action the ordinary means of control are completely blocked, but the direction of the machine can be changed laterally or longitudinally by small supplementary levers.



Front view of Sperry stabilizer.

Showing servo-motor at right and rear of gyroscopic group, regulator in front to the left; anemometer above attached to engine strut



Rear view of Sperry stabilizer.

A, automatic lateral lever pivoted on valve control crank; *B*, wire leading to supplementary control lever; *C*, control lever (lateral); *D*, gyroscope; *E*, inclinometer; *F*, cylinder of servo-motor; *G*, suspension ring; *H*, control lever (longitudinal); *J*, longitudinal control cylinder.

On Thursday, June 18th, at Bezons, near Paris, I saw the first demonstration before the committee of the Concours pour la Securité en Aéroplane. During the flights Lawrence Sperry, the pilot, stood up with his hands above his head, abandoning all controls, while the mechanic left his seat and climbed out on the right wing, 6 feet from the longitudinal axis of the machine. As the passenger weighed 170 pounds, the upsetting moment was 1,020 foot-pounds. The first time this was done the aeroplane described a wide turn to the right owing to the extra head resistance, but on the second trial the machine kept its course perfectly, the pilot having set the rudder to the left before abandoning control. In neither case was the stability of the machine affected in the slightest degree, the ailerons automatically changing their angle of incidence so as to keep the aeroplane on an even keel.

Later the mechanic climbed back to the trailing edge of the plane, and this time the elevators corrected the upsetting moment. By reducing the speed of the motor the flights were terminated with automatic glides down to the surface of the Seine. After these flights Sperry took up Commandant Barres and Lieutenant Caylo successively to observe that he did not touch the control levers when the stabilizer was in operation.

The committee was so interested that they asked for a second series of tests, which took place the following Tuesday. On this occasion Réné Quinton, the *president of the Ligue Nationale Aérienne*, was carried as a passenger for half an hour. Although a high wind was blowing at the time, the aeroplane was entirely unaffected, thanks to the stabilizer. The tests indeed were so successful that the committee of the Concours has awarded first prize, 50,000 francs, to the Sperry automatic stability device. The grand prix, 400,000 francs, has not been won this year.

The Mont Blanc Observatories

OF the two famous observatories that have existed on Mont Blanc, that constructed on the very summit by Janssen, in 1893, no longer stands. It was built entirely on the snow and ice, as borings to a depth of 70 feet failed to find rock. A few years ago this building tilted over and gradually sank into a fissure, supposed to have been caused by an earthquake. Its turret is now preserved in the Alpine Museum at Chamonix, while the rest of the building was mostly used up as firewood at the neighboring Vallot Observatory. The question of building another observatory on the summit is now under consideration. During the present summer a commission consisting of the astronomers Hamy, Puiseux and Stefanick, the veteran Alpinist, Vallot, and the physiologist, Dr. Bayeux, are to ascend the mountain and investigate the possibility of carrying out this project. The Vallot meteorological observatory, which is not on the summit, but on the Rocher des Bosses, was constructed in the summer of 1898, on the site of a still earlier observatory, dating from 1890. It is a small one-story structure of wood, sheathed in copper, containing two laboratories, a dining-room, a kitchen, and a workshop, and accommodates seven people. M. Vallot, who has made upward of thirty-six ascents of Mont Blanc, usually spends the month of August at his observatory, with a few scientific colleagues as his guests. The observatory is not, like that on Monte Rosa, connected with the world by telephone, but optical signals are exchanged with Chamonix.

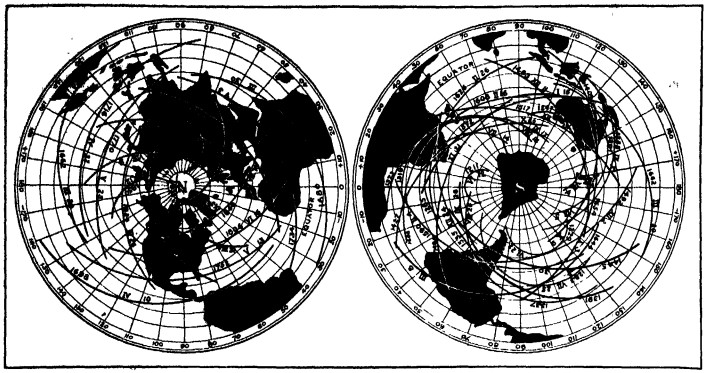
In preparation for the coming fire season in California, 110 miles of fire line have been built in the Sierra national forest.

Graphic Prediction of Solar Eclipses

By Samuel W. Balch

THE method of predicting an eclipse is for most people much of a mystery, and, in its ultimate refinements, must so remain, but there are some rough methods which are easy to understand, and which were probably used in ancient times. If a careful record be kept of eclipses observed all over the earth, it will be found that while they follow each other in a seemingly erratic manner, sometimes a month, and sometimes five or six months apart, the programme is very nearly repeated at intervals of 18 years, 10 or 11 days, 8 hours. The variation of an even day is because sometimes four leap years and sometimes five leap years fall within the period. The actual length is always very nearly 6,585⅓ days. This period is known as the Saros and was discovered by the ancient Babylonians. Eclipses depend chiefly on three celestial revolutions; *a*, the revolution of the earth around the sun; *b*, the revolution of the moon around the earth; *c*, the revolution of the line of nodes. The plane of the moon's orbit is inclined five degrees to the plane of the earth's orbit and the line of intersection of the two planes is the line of nodes. In the Saros period there are 241 revolutions of the moon with respect to the stars, or exactly 223 revolutions with respect to the sun. There is also one revolution of the line of nodes with respect to the stars, or 19 revolutions with respect to the sun in the Saros period. The revolution of the line of nodes fits the period with an error of one half of a degree, but the shadow will strike the earth when the moon is within eleven degrees either way from the node at conjunction, so that forty-four recurrences will fall within the span of twenty-two degrees. The years contained in the Saros also being close to a whole number, it follows that this period brings the earth, sun, and moon back to very nearly the same position. So, starting with any eclipse and counting backward or forward or both by this interval a long series can be listed. The one which is to occur on the 21st of next August is the fortieth of such a series of forty-four total eclipses of the sun, the first of which cast its shadow on the South Atlantic the 12th of July, 1211, and the last of which will cast its shadow on the North Atlantic the 3rd of October, 1986. The shadow paths of the entire series are shown on the accompanying maps. They were plotted from calculations given in a monumental work by Theodore Ritter v. Oppolzer, and afford an excellent example of how the rhythm of Nature concealed in mathematical calculations may be graphically revealed.

This series of total eclipses was preceded by a series of partial eclipses visible at the south pole, and will be followed by a series of partial eclipses visible at the north pole and extending the series over a thousand years. The earth's revolution being contained in the Saros with nearly one third remainder causes successive shadow paths of eclipses in a series to be spaced one third around the earth and the paths of any three consecutive eclipses in the series make a spherical triangle on the earth's surface.



Map showing series of forty-four total eclipses, beginning July 12th, 1211, in the South Atlantic, and ending October 3rd, 1986, in the North Atlantic.

The want of similarity between the patterns formed by the eclipse paths of this series in the northern and southern hemispheres requires explanation. It is one of the cardinal principles of science that like causes should produce like effects and the cycles which regulate eclipses have remained unchanged. The cycle of the year does not fit the Saros by eleven days, so that successive eclipses in the series are progressively later in the season. The seventeen eclipses from the 4th of August, 1247, to the 24th of December, 1535, if the shadow could penetrate the earth and reach the earth's axis, would be found to cross the axis progressively farther north. As this spectra covers the spring months of the southern hemisphere when that end of the earth is turning toward the sun, the two motions offset each other so that each eclipse is caused to cross south latitude 35.

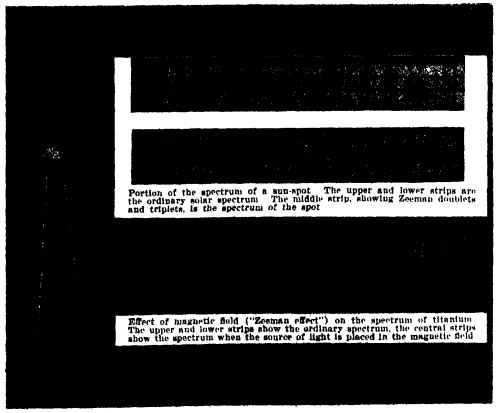
The eclipses of this series which fall on the northern hemisphere occur during the summer months when the declination of the sun is nearly stationary and does not offset the northward movement of the successive shadow paths.

The eclipses of the 16th of January, 1572, and before are noted according to the Julian calendar, and the eclipses of the 4th of February, 1590, and subsequently, are noted according to the Gregorian calendar, and this causes an apparent extra spacing of ten days at the point of change.

The series is notable for the number which afforded an opportunity for scientific observations. The eclipse of 1842 had a path of totality from Perpignan, France, through Milan and Vienna, over Russia and central Asia to the Pacific Ocean. The eclipse was of over four minutes' duration at each point and detailed physical observations were made. The path of totality in 1878 was from Wyoming to Texas and included many stations at high altitudes. There were unusual opportunities for photographing the corona at Cherry Creek, near Denver, and at Fort Worth. The eclipse path in 1896 reached from Norway to Japan. The reversing layer of the sun was photographed by Shackleton in Novaya Zemlya, and Russians obtained photographs in Siberia and Lapland.

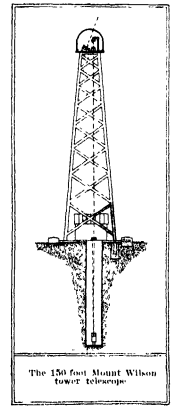
The shadow of the eclipse on the 21st of August, 1914, will begin at sunrise north of North America, lead across the northern end of Greenland, Norway, Sundsval, Sweden, Riga and Kief, Russia, the Black Sea, Trebizond, Turkey in Asia, and into Persia. The United States east of and including the Great Lakes and north of Washington is within the limits at sunrise.

In the chart here presented the paths were plotted by drawing arcs of circles through three calculated points. Owing to the unavoidable distortions of a flat map the paths are, in some cases, in error between the calculated points. For the best available information consult the large maps in the Nautical Almanac.



Portion of the spectrum of a sun-spot. The upper and lower strips are the ordinary solar spectrum. The middle strip, showing Zeeman doublets and triplets, is the spectrum of the spot.

Effect of magnetic field ("Zeeman effect") on the spectrum of titanium. The upper and lower strips show the ordinary spectrum, the central strips show the spectrum when the source of light is placed in the magnetic field.



The 150 foot Mount Wilson tower telescope.

Instruments and methods used in solar research.

Recent Progress in Solar Research

By Walter M. Mitchell, Ph.D.

AMONG the discoveries made during recent investigations of the sun, the most interesting is undoubtedly the discovery of the sun's magnetism. The first evidence of the existence of magnetic action on the sun was obtained through the brilliant discovery by Prof George E. Hale of the Mount Wilson Solar Observatory, that certain phenomena in the spectrum of sun-spots which had been observed by the writer while at Princeton, were due to the effects of magnetic action in the sun-spots themselves. Within the last year has come the announcement that not only is there local magnetic action in the sun-spots, but that the whole sun is probably a gigantic spherical magnet, and similar to the earth, the poles of its magnetism agreeing approximately with the poles of its rotation. In addition, from the investigations through which this discovery was made, the intensity of the sun's magnetic strength has been found to be about eighty times that of the earth, and the kind of magnetism, or polarity, as it is techni-

cally called, is similar to that of the earth, i. e., the north magnetic pole lies near the north pole of rotation.

It will be of interest to describe briefly how these discoveries were made. Nearly twenty years ago, Prof. Zeeman of the University of Amsterdam made the discovery that if the light emitted by a source placed in a powerful magnetic field, for example an electric spark between the poles of a large electromaguet, was examined with a powerful spectroscope, the lines in the spectrum of the element were seen to undergo a remarkable change. Formerly single, they now became double, triple, or even quadruple. From the name of the discoverer this phenomenon became known as the "Zeeman effect." By examining carefully the components of the multiple lines with suitable optical apparatus, it became evident that this multiplication could always be recognized as such, and hence, would afford a conclusive test for the evidence of magnetic action.

Atmospheric Disturbances Observed.

Observations of the sun with an instrument called "spectroheliograph" had given unquestionable evidences of whirlpool or vortex action on the sun's surface in the vicinity of sun-spots. Theoretical considerations showed that the rapid rotation of the intensely heated particles of the sun's atmosphere would tend to generate a magnetic field at the center of the vortex. The writer had detected the presence of doubled and tripled lines in the spectrum of sun-spots at the Princeton Observatory, hence, the very interesting question arose, might it not be possible that these doubled and tripled lines were really Zeeman effects, indicating the presence of a magnetic field in the sun-spot? Through the brilliant investigations of Prof. Hale this was found to be the case

The Instruments Used.

The apparatus with which this remarkable discovery was made was the now famous "tower telescope." As the equatorial telescope, which is ordinarily used for astronomical observations, had been found somewhat unsatisfactory for solar investigations, it was necessary to devise some other form of apparatus which would be free from the objectionable features of the older style. As an experiment, a preliminary tower telescope was constructed, it being the intention of the Mount Wilson observers to construct a larger and more complete instrument should the experiment prove satisfactory. The tower telescope consists of a tower of light metal framework, at the top of which is placed the principal lens or object glass. By a suitable arrangement of mirrors, driven by clockwork so as to counteract the effect of the earth's motion, a beam of sunlight is directed vertically downward through the object glass. Immediately under the tower, in a pit, is placed a large and powerful spectroscope. The chief advantages to be gained by this novel construction were the avoidance of the effects of atmospheric disturbances, which were found to be greatest near the surface of the ground, and stability and surroundings of constant temperature for the spectroscope. The experimental tower proved the feasibility of this form of telescope, consequently a much larger tower was designed and constructed. This tower was made 160 feet high, the lens, of 150 feet focal length, giving an image of the sun's disk nearly 17 inches in diameter. The spectroscope, 75 feet in length, was placed in a pit 80 feet deep. With this gigantic instrument it is possible to photograph the solar spectrum on the very large scale necessary for the accurate measurements required.

The Sun a Gigantic Magnet.

As we have seen, the existence of magnetic force in sun-spots is indicated by the doubled and tripled lines in sun-spot spectra. Now, if the sun as a whole were a magnet, with its poles near the poles of rotation, the strength of the sun's magnetic field would be greatest near the poles, decreasing as we approach the solar equator. Therefore, the lines in the spectrum of the light from regions near the sun's poles should show the greatest effect, and that from the sun's equator the least effect. To examine the light from any particular region of the sun's surface is a comparatively simple proceeding. All that is necessary is to arrange the apparatus so that the particular region of the sun's image in question falls on the slit of the spectroscope, and the required spectrum will be at once obtained. The strength of the sun's general magnetic field is not sufficient to produce an actual doubling or tripling of the spectral lines, but instead the lines appear widened or broadened. Careful measurement of the amount of this widening at different points on the sun's disk gave results which agreed so closely with theoretical requirements that the correctness of the hypothesis was very strongly indicated, namely, that the sun is a gigantic magnet. The determination of the strength of the sun's magnetic field, however, is a matter of considerably greater difficulty owing to the extreme minuteness of the quantities to be measured, but the results obtained indicate that the strength of the field at the poles is of the order of fifty gausses, that is, about eighty times the intensity of the earth's field. It may be remarked that the strength of the magnetic field in the sun-spots is occasionally as great as one hundred times the strength of the sun's general field.

The Nature of Sun-spots.

The sun-spots themselves have been an ever fruitful cause for speculations regarding their nature since their discovery by Galileo in 1610. Many theories have been advanced, only to be rejected on the advancement of our knowledge of the actual physical conditions existing on the sun. But the recently constructed instruments of the Mount Wilson Solar Observatory have rendered possible the detection and measurement of the small movements of the gases in the sun's atmosphere, so that now we are on a much surer footing regarding our knowledge of their behavior at the sun's surface. For many years it has been known that the motion of a source of light would cause displacements of the lines in its spectrum—the so-called Doppler effect—and that from the magnitude of these displacements it is possible to ascertain the velocity of the source of light as well as the direction of its motion. It is by means of this Doppler effect that we have been able to study the motions of the vapors and gases comprising the sun-spot and its vicinity, and from the results so obtained a tentative hypothesis of the nature of sun-spots has been proposed which bids fair to become adopted. According to this hypothesis, the sun-spot is a vortex resembling our terrestrial tornado or hurricane. On the sun, the vortex is probably deep seated, the spot which we see being merely the disturbance produced in the photosphere by the vortex far beneath it. The circulation, as in the tornado, is spirally upward and then outward along the surface of the photosphere. The displacements of the lines in the spot spectrum show that in the so-called reversing layer of the sun's atmosphere the phenomena represent an actual flow of the gases out of the spot along the photosphere. Low pressure in the center of the vortex causes expansion with consequent cooling, and a dark cloud results, forming the umbra of the spot which is so conspicuous to the eye. As a secondary effect, the gases of the higher regions of the sun's atmosphere, i. e., the chromosphere, are sucked down into the spot.

Sun-spots Periodic Phenomena.

Unfortunately during the last few years there have been few opportunities in which to study the motions of the spot vapors. As is well known, sun-spots are a periodic phenomenon, the maximum number being visible about every 11.1 years. Just at present we are at the minimum period, and a very well marked minimum it is. For during the last hundred years there has been no year in which there have been fewer sun-spots than the year 1913; there being 320 days on which no spots were visible.

Heat from the Sun.

The amount of heat which the earth receives from the sun is always an interesting topic for discussion—particularly at this time of year. While we are still unable to predict the approach of a "hot wave" from any phenomena of the sun, we have found that the amount of heat received by the earth is not the constant quantity that it has been hitherto supposed to be. Technically speaking, the so-called "solar constant" is now known to be variable. The heat received at a given place on the surface of the earth depends upon various conditions, such as the altitude of the sun above the horizon, the time of year (the sun's distance depends upon this), and last, but not least, the conditions of the earth's atmosphere. In order to avoid considering these quantities, the unit known as the solar constant has been introduced. The solar constant is the number of heat units which will be received by a square meter of the earth's surface in a unit of time if exposed to the perpendicular rays of the sun and unprotected by the earth's atmosphere. From the results of recent measurements at the Smithsonian Astrophysical Observatory the value of the solar constant has been found to be 10.3 calories per minute (the calorie being the quantity of heat necessary to raise the temperature of a kilogramme of water 1 deg. Cent.). Converted into more familiar units 10.3 calories are equivalent to about 1.8 horse-power, of which more than one third is lost to us through absorption in our atmosphere.

The determination of the value of the solar constant is greatly embarrassed by the uncertainty of our knowledge of the amount of heat lost in transmission through our atmosphere. Since we are obviously unable to get outside of the atmosphere in order to make measurements, the effect of its absorption must always be, to a certain extent at least, uncertain. Our present knowledge is derived by extrapolation from results of observations made simultaneously at as widely different altitudes as possible. In this country, observations have been made at Washington, D. C.; on Mount Wilson, Cal. (5,886 feet); and on the summit of Mount Whitney, Cal. (14,502 feet). During several years' observations at Mount Wilson, variability, with a range of about 10 per cent, was suspected in the solar constant. The fluctuations seemed to occur irregularly, sometimes with a period of only a few hours, sometimes longer. To determine the reality of this it appeared necessary to establish another station so far removed from Mount Wilson that local influences could not be expected to alter the results at both stations on the same day. Such a station was established at Bassour, Algeria, during the summers of the years 1911 and 1912. Simultaneous observations at these widely different stations showed that when high values for the solar constant were obtained at Bassour, high values were also obtained at Mount Wilson, and *vice versa*. Thus the fluctuations which have been found appear to be truly existing in the solar radiation outside of the earth's atmosphere.

Do Sun-spots Influence Weather?

Just what influence upon weather conditions will be found to result from the fluctuations in the solar constant is difficult to say. At first glance it would seem that there must be some effect, but so far observations have shown no signs of it. The conditions which determine the changes in the weather at any given time or place are so numerous and so varied that it is doubtful if a short period variation in the solar constant would produce an effect which could be directly traced to its cause. However, one very curious result has been found in relation to the periodicity of sun-spots, namely, that at times of sun-spot maximum the solar constant has a relatively higher value than at minimum. The curious part is, that observations seem to show that the earth's temperature is slightly cooler at the spot maximum, notwithstanding the fact that if the above result be true, the solar radiation is at this particular time more intense. Up to the present this apparent contradiction has not been satisfactorily explained.

What the future will bring forth in solar research is difficult to predict. The new spot cycle which is just beginning will certainly yield new material from which our knowledge of sun-spot conditions will be increased. Much information is needed with which to test the newer theories of the constitution of the sun; the classical theories have been challenged by recent investigators, for the new data which has been obtained make the premises on which the older theories are based somewhat uncertain. The accuracy of the accepted value of the solar constant is also open to some doubt, as is shown by the discovery of an unsuspected variation in its value. To overcome the uncertainties of low altitude observations, it is planned to equip balloons with automatic registering apparatus. In this way it is hoped to obtain observations at altitudes as great as 100,000 feet, which, if successful, may be expected to remove any uncertainties now existing.

Forty Tons at a Single Scoop

IT is possible to indulge in superlatives when describing the Panama Canal, without much fear of running into exaggerations. As a matter of fact, it was the magnitude rather than the intricate or untried nature of the work at Panama that rendered it famous the world over. Not alone was the work stupendous in itself, but it called for the provision of some of the largest excavating machinery in existence, and the quantities of material handled by these appliances have provided many a record for excavation, transportation and the emplacement of masses of concrete. Two of the most notable machines, in respect of their capacity, were ordered by Col. Goethals, near the close of the work, for the particular purpose of tackling the enormous slides which have delayed the opening of the canal for several months. We refer to the two large dipper dredges, the "Gamboa" and "Paraiso," which were built by the Bucyrus Company, and are now at work cleaning up what remains of the great Cucuracha slide preparatory to the formal opening of the canal in 1915.

The two dredges, which were described in our issue of May 9th, 1914, are of the dipper type. Each dredge displaces about 1,500 tons, and each is provided with two sizes of bucket, one of ten and the other of fifteen cubic yards capacity. For the present the dredges are using their 10-yard buckets, because of the heavy character of the work and the large size of broken rock in the slide. The power of the dredges is well illustrated by the size of the rocks which they have been lifting, several of these having run from twenty to forty tons in weight. The greatest piece of lifting yet accomplished is illustrated on the front cover of this issue, which represents one of the dredges with a rock of forty tons weight carried upon its ten-ton dipper. It was found impossible to place these boulders on a scow, for the reason that in spilling them on, they would have gone right through the bottom. Therefore, they were drilled and mud-capped while resting on the dipper, and in this way they were broken somewhat, so that the dredge was able to pick them up in smaller pieces which could be handled on the scow. When the material encountered becomes less severe, they will be equipped with their 15-cubic yard capacity dippers. At present these are the two most powerful dipper dredges in existence.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A Non-sinkable Ship Suggestion

To the Editor of the SCIENTIFIC AMERICAN:

You have discussed non-sinkable ships. Why not build one? I have seen a non-sinkable motorboat. Why not a ship?

We simply filled the vacant space in the boat with small air-tight cylinders, and the trick was done. One hundred one-gallon, air-tight cylinders giving about 600 pounds buoyancy were easily stowed under decks and other vacant places, and if half the bottom was torn off the boat would float.

If all the vacant space in a liner were filled in a similar manner, and, if necessary, some space usually allotted to cargo, passengers, etc., utilized, the liner would not sink if half a side was torn open, or if she was cut half in two.

Of course, some of the small air-tight cylinders would be crushed in a collision or other accident, but an excess of cylinders should be stowed to provide for possible loss. This idea may be a golden dream or a wild scheme unworthy of notice, but I believe a million small air-tight cylinders properly stowed would solve the problem. Take it for what it is worth.

Buffalo, N. Y. J. W. KALSS.

[The plan of our correspondent might be feasible in small vessels, such as motorboats and lifeboats; but because of painting necessities and difficulty of inspection, it would be impracticable in a liner.—EDITOR.]

Suggestion for Measuring the Speed of Yachts

To the Editor of the SCIENTIFIC AMERICAN:

In reading the issue of July 11th, I was quite struck with an article, or rather communication, of Mr. F. B. Abbot of Sharon relative to the testing of a yacht's speed with a log. While there is little doubt but that he is right, I would say that there is a way which may be available to obtain this same data, which I wonder has not been made use of before, or been suggested. I refer to the use of the position finding equipment which is installed in all of our coast fortifications. While descriptions of this equipment have from time to time appeared in your valued paper, it may be as well to state that in brief the method employed is to plot on a so-called plotting board the position of the target at a given interval of time, the standard for the present being 30 seconds. This plotting is done on a scale of 800 yards per inch. A travel of approximately fifteen yards in an observation interval of 30 seconds represents a speed of one mile per hour. This is represented by a distance of one twentieth of an inch. Hence a change in speed of a half a mile should be readily discernible on the plot. The advantages of this method over the use of the log would seem to be manyfold. In the first place much shorter runs can be used to obtain the data desired than would be the case were a log employed.

Furthermore, a record of the compass course compared with the plot will give one a very accurate line on the leeway made in the case of a sailboat. Without going further into the advantages of this method it seems that there can be little doubt of the possibilities of it to anyone who gives it serious thought. Of course it would be necessary to obtain the co-operation of the War Department or the officers in command of convenient posts, but considering the attitude of both the Army and Navy Departments in the past toward all kinds of health sports, there should be little to be feared from opposition to the plan.

If the work should perhaps prove too onerous to the regular troops stationed at a post, undoubtedly volunteers could be obtained from the coast artillery reserves, who would be glad to co-operate in this work.

Boston, Mass. HAROLD H. BROWN.

The Introduction of Vaccination into the United States

To the Editor of the SCIENTIFIC AMERICAN:

I recently read in a medical work, in reference to vaccination for small-pox, as follows:

"Vaccination for small-pox was first introduced into this country in 1799, by Prof. Benjamin Waterhouse, first professor of medicine in Harvard University."

As a matter of fact, however, the practice of vaccination was introduced seven years prior to the date as ascribed to Prof. Waterhouse.

As vaccination has become a very important factor in the general welfare of the country, perhaps you would care to publish a short statement of its introduction into this country, as it may prove of value as a source. With your permission, it will be necessary to quote a little from family history, the subject being my paternal grandparent.

"William Yates was born at Sapperton, near Burton-on-Trent, England, November 13th, 1767. He inherited his father's estates and titles, and was a cousin of Sir John Howard, the philanthropist, and Sir Robert Peel. He took up the study and practice of medicine as a pastime, attending the poor and needy free of charge.

"Dr. Yates became distinguished as a philanthropist. He studied with Dr. Jenner, the discoverer of vaccination, and became one of Jenner's most enthusiastic supporters. Becoming deeply interested in the new republic (the United States), and its principles, he abdicated his titles to a younger brother and came to Philadelphia, Pa., in 1792, bringing with him some of Dr. Jenner's virus. He then made public the discovery in Philadelphia, and practised vaccination there and elsewhere for many years. Having made the acquaintance of Judge Cooper of Otsego County, N. Y., Dr. Yates purchased a large tract of land in the same county, where he resided until his death, March 7th, 1857."

It may be worth noting that the method first used by Dr. Yates in vaccinating was to apply it to the hands and between the fingers in imitation of the natural way "cow-pox" was acquired by the milkmaids in England.

If there is record of vaccination prior to the above date I should be glad to be advised. N. S. YATES.

Honeoye Falls, N. Y.

The "America's" Trip Postponed

The Test With Three Motors

By Our Staff Correspondent at Hammondsport

PURSUANT to the programme announced in last week's SCIENTIFIC AMERICAN, Mr. Curtiss installed in the airboat "America" a third 90 horse-power motor and a direct-connected 8-foot Garuda propeller which protruded before the leading edge of the top plane, while the engine rested on a trestle work supported by the main spars. Along each side of the bow, flush with the chines, he attached an early type of efficient, bilge-keel-like, unbuoyant planing fin, 18 inches wide at its rear end, and curved to a point at its front, where it terminated with an upward bend, near the prow. These fins, as the vessel acquired headway, were to exert a dynamic lift and enable the boat readily to mount the water surface and plane efficiently before rising into the air. The third motor was cranked from the aviator's seat by pulling a cable leading to a ratchet crank on the rear end of the engine shaft. These changes occupied the workmen from Saturday evening, July 18th, to the following Wednesday night.

Next morning Mr. Curtiss, as pilot, launched forth with five additional men and sufficient supplies and ballast to make a total load of 4,500 pounds. Under the full thrust of her Garuda and two Olmstead propellers the great craft came quickly to the surface, planed handsomely, and rose into the air with great ease. She was attended by several motorboats bearing expert witnesses, and by the Curtiss "scooter" carrying three naval officers, and skimming over the surface at 40 miles an hour. A large throng of citizens and tourists witnessed the event from the shore. Going from shore, Mr. Curtiss quickly distanced all the water craft. Returning with throttled engines, he played the "America" in hundred-yard bounds along the surface, followed at even pace by the strenuous scooter and the three naval officers, their hair streaming and shirt sleeves fluttering. It was a novel sight, this saucy sea dog straining at terrific pace, as if to devour the great red-winged whale, frolicking along without effort a yard or two above the water. On a subsequent trial the scene was enlivened by boatloads of spectators, camera men, and a moving-picture operator standing erect in a swaying naphtha launch and turning his crank with sublime energy and gravest attention to business.

In the early evening Mr. Curtiss made a triumphant flight which seemed to justify his best expectations of the third motor. Taking with him three passengers and enough supplies and ballast to aggregate over 6,100 pounds, he flew the "America" with as much ease and security as he had ever done with the lightest burden. The useful load was 2,600 pounds, all that seemed necessary for a non-stop flight to the Azores, even with three motors running.

Next evening a run was made to find the rate of fuel consumption. Porte and Hallett flew light to Pen Yan and return, thus doubling the length of Lake Keuka, and covering forty-four miles. The third motor was inactive, but turned slowly under the wind-mill torque of its idle propeller. The fuel consumption averaged about a pound and a half per mile, or was so reported. At full load the rate would be rather more. Thus over 1,800 pounds, say a ton, of gasoline would be required for a fair run to the Azores. This taken from 2,600 pounds useful load leaves 600 pounds for pilots, provisions, oil, and a little margin of fuel. As only one pound of fuel per mile had been allowed in previous estimates, this run was disconcerting. Further tests were required to improve the efficiency of the propulsive system and of the craft as a whole. It was also recalled that during the past month some slight accidents had happened which, should they occur at sea, might terminate prematurely the transatlantic voyage.

Next morning, July 25th, Mr. Curtiss recommended to Mr. Will Gash, Rodman Wanamaker's representative at the trials, a postponement of the ocean flight till October. August was too near; September too stormy. Less than a week remained to perfect the "America" and ship her to New York, for the boat of August 1st, so that she could sail from Newfoundland by the full moon. In so brief a time, many improvements would have to be left untried, some blemishes left unremoved which might jeopardize the success of the voyage. Mr. Gash, after consulting Lieut. Porte, agreed, on behalf of Mr. Wanamaker, to Mr. Curtiss's proposal. After all, Mr. Wanamaker's chief objective was not so much flying the Atlantic as perfecting a craft capable of flying it with security and precision.

The "America" was now returned to the factory to be remodeled in accordance with the month's experience. Her bottom would be lengthened and more gradually rounded upward toward the prow, it would also be widened to give the effect of the very efficient planing fins. The step would be more nearly flat, the fore part of the bottom would become more deeply concave toward the prow. The vibration of the motors would be corrected. Various minor improvements would be made, and the airboat would be ready for a new trial in about two weeks. In the meantime Lieut. Porte and the other newspaper correspondents would discontinue their daily stories, retire from Hammondsport, and allow Mr. Curtiss to pursue the even tenor of his way.

In order to overcome the difficulty the aeroplane "America" is encountering of carrying sufficient gasoline for the long flight of 1,200 miles from St. Johns to the Azores, the Aero Club of America proposes to locate a supply boat on the Flemish Cap shoal, 420 miles southeasterly from St. Johns, thus dividing the first long lap into two of moderate length. As the first portion of the flight would be made at night, it is believed that a flare on the supply barge would enable it to be easily found.

Horace C. Hovey

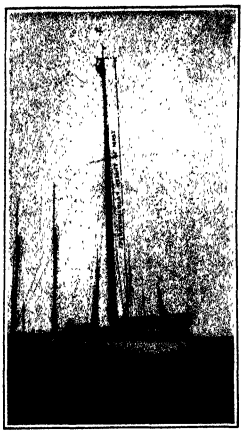
IN noting the decease of Dr. Horace C. Hovey on July 27th, 1914, at his home in Newburyport, Mass., in his eighty-second year, we lost a valued contributor to the SCIENTIFIC AMERICAN. He was a western man by birth. His father, Edmund Otis Hovey, residing at Crawfordsville, Ind., was founder, trustee, and treasurer of Wabash College there, and occupied the chair of geology and chemistry.

Dr. Hovey was graduated from Wabash College in 1855, and later at Lane Theological in 1857. In 1858 he was ordained for the ministry, and became pastor of Congregational and Presbyterian churches in the eastern and western sections of the country, finally locating in New England, the latter part of his life. His interest in geology never abated. He was particularly at home on the subject of cavern geology and the origin of caves, especially the great Mammoth cave in Kentucky, also the Luray cave, in Virginia. In 1912 there was published an authentic "Manual of the Mammoth Caves of Kentucky," edited by Dr. Hovey and R. Ellsworth Call, M.D., Ph.D., illustrated by maps and engravings, written in a popular, interesting style, and is a fitting memento of Dr. Hovey's abilities in this direction. He was an interesting and entertaining lecturer and a fluent writer. He leaves a son, Dr. Edmund Otis Hovey of New York, geologist and curator in the New York Museum of Natural History.

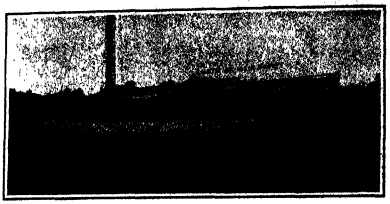
Dr. Hovey was a member of the American Association for the Advancement of Science, the Geological Society of America, the International Geological Congress, and Society of Spelology.

The Current Supplement

THE opening article of the current SUPPLEMENT No. 2014 is intended to present to the general engineer an idea of what the Diesel engine is and to show its possibilities.—The proposed improvement of the Norfolk Navy Yard is described and illustrated.—Prof. Henry G. Gale writes most interestingly on the experimental determination of the earth's elastic properties.—One of the most important contributions to the literature of the aeroplane is a paper which Mr. Frederick William Lanchester recently read before the Institute of Civil Engineers in London. It is entitled "The Flying Machine from an Engineering Standpoint," and the first installment of it is published in the current SUPPLEMENT.—A good account is published of the Lassen Peak eruptions with photographs.—Mr. A. J. Wallis-Tayler's paper on the preservation of wood is concluded.



Measuring perpendicular height of the mast.



Taking the length of the main boom.

How Yachts Are Measured

Determining the Rating of a Racing Yacht for Classification and Time Allowance

By Herbert T. Wade



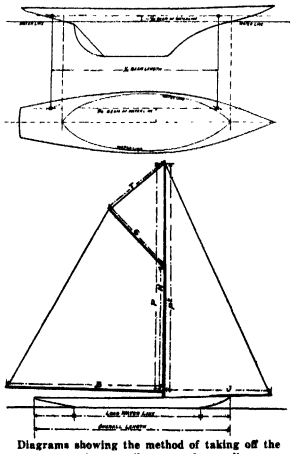
Measuring the hoist of the mainsail.

THE measuring of racing yachts for purposes of classification and time allowance presents many points of interest. The subject not only has wide general interest, but is of importance at the present time in view of the coming races for the "America's" Cup, in which the deed of gift and the supplemental agreement under which these races are sailed provide that the racing rules of the New York Yacht Club, with modifications duly agreed upon, should apply. These racing rules, which are fundamental in American yachting, and which, as regards measurement and rating, it may be said, vary somewhat from those in force in Great Britain and elsewhere in Europe, provide that a yacht should be rated for classification and time allowance according to a mathematical formula into which certain quantities derived from actual measurement enter.[1] As thus defined the measurement or rating of a yacht is 18 per cent of the product of the waterline length multiplied by the square root of the sail area, divided by the cube root of the displacement, or expressed as a formula:

$$\text{Measurement} = 0.18\,\frac{L\sqrt{S}\ A}{\sqrt[3]{D}}$$

This is the measurement and rating for classification and time allowance, but the rules also provide that a yawl shall be rated at 93 per cent and a schooner at 90 per cent of their measurements as determined from the above formula. The reason that the factor 18 per cent is used, is to reduce the numerical value obtained from the formula to a figure approximating the actual length of the yacht, so that a yacht of 50 feet rating might correspond in length somewhat to that figure rather than to a numerical expression that otherwise would mean nothing.

This fundamental formula naturally is based on the fact that the longer the boat on the waterline the larger and more powerful it will be. Obviously, as the sail area is increased, the rating which involves both speed and power should increase, but, as the formula indicates, it will vary not directly with the increase in the sail area, but as the square root; that is, four times the sail area would double the rating. On the other hand, a large displacement would act to reduce the rating; consequently the cube root of the actual displacement is used, so that an owner is encouraged to build a boat with a large displacement so as to secure seaworthiness. The length *L*, as used in the formula, is not, however, the actual load waterline length or



Diagrams showing the method of taking off the quarter-beam, sail area, and waterline measurements.

distance between the points farthest forward and farthest aft in the plane of flotation; nevertheless this is the distance from which all calculations are made, including the displacement, quarter-beam length, and draft. *L* is a corrected length, which includes the load waterline length plus one half the excess of the quarter-beam length over the percentage of load waterline length given by the formula:

$$\text{Percentage} = 100\ \sqrt{\text{L. W. L.}}$$

The quarter-beam length is a dimension measured in a line parallel with the middle fore-and-aft vertical plane, at a distance from it equal to one fourth the waterline breadth and one tenth of its breadth above the load waterline plane. For boats over 100 feet load waterline the percentage in the formula above is 90. Provision is made for bridging concavities or local jogs or notches at the point of measurement to prevent cheating the measurement.

The quarter-beam provision is introduced to prevent the scow type of floatage, and, like other provisions in the racing rules, serves to penalize ships that might not prove generally seaworthy, yet have a high speed under certain conditions. In fact, the whole general scheme of rating, classification and penalties aims at the elimination of freak vessels. It might be said in passing that American design has moved away from freak vessels, and what exception could be taken to the modern American racing yachts in regard to their seaworthiness must be based rather on structural features, as lightness of construction has been carried to such a point that the racing yacht has had its weight reduced to a point where, if not comparable to an airship, yet it shows a marvelous degree of lightness that is not in keeping with permanence or with cruising strength such as might have been associated with cup defenders and racing yachts of an earlier date.

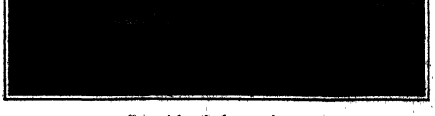
In actually measuring a yacht, the official measurer, supplied with a steel tape carefully standardized, makes a series of measurements of and aboard the vessel. To obtain the actual waterline the tape is stretched horizontally on deck from the extreme bow of the vessel to the extreme taffrail and the distance noted. This, of course, requires that the tape should be stretched around the mast, and a correction for this small amount must be made before the true length is found. Then from the extreme points at the bow and stern a plumb-line and bob is dropped, and the measurer, or one of his assistants, notes the distance on a floating batten, or spar, from the point of the bob to the point of contact of the batten with the bow or cutwater at the waterline. The same process takes

(Concluded on page 108.)

[1] It is reported that several foreign yacht clubs are now considering the adoption of the American scheme of measurement.



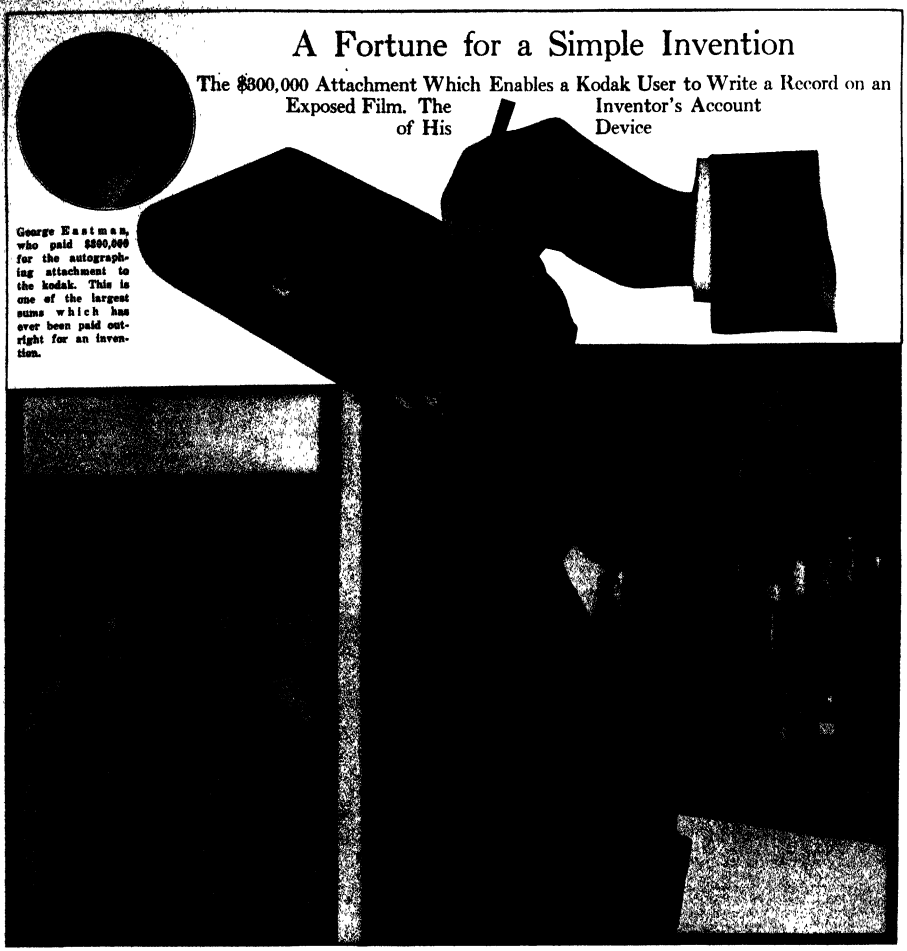
Measuring the stern overhang.



Determining the bow overhang.

A Fortune for a Simple Invention

The $800,000 Attachment Which Enables a Kodak User to Write a Record on an Exposed Film. The Inventor's Account of His Device



George Eastman, who paid $800,000 for the autographing attachment to the kodak. This is one of the largest sums which has ever been paid outright for an invention.

Record made on picture by means of Mr. Gaisman's invention.

Henry J. Gaisman, inventor of the attachment.

The Autographic Kodak

THE autographic kodak attachment, of which we have heard so much, is located on the back of the camera. It is essentially a spring door covering a narrow slot through which it is possible to write upon the film.

The autographic film is different from other films in that it is made with a thin red instead of the familiar thick red and black (duplex) paper. When the small door in the back of the camera is open it is possible with a metal stylus or lead pencil, or any pointed instrument to write on the back of the red paper, thus exposed. Between the red paper and the film is a strip of tissue paper. The tissue paper serves two purposes: it supplements the red paper in making the film cartridge light-proof, and it permits the recording by light of the writing upon the film.

The device may be used either to record the title, place and date of the picture, or to make a record of the time, exposure and conditions of exposure. In other words, the autographic kodak is of equal value to the amateur and the professional. The amateur, perhaps, is taking pictures in unfamiliar territory. It may be several weeks before the photographer will see his developed films and prints from them. In the meantime he is likely to forget some of the unfamiliar scenes or some of the unfamiliar faces. That cannot happen when the new camera is carried. With his stylus the photographer will write through the little door the title of the picture, or whatever notes he pleases. When he develops the film he will find his words recorded at the bottom of each film, to appear in the print he wishes or to be cut off once the picture is identified. The professional can record on every exposure light, conditions, stop, etc. When he comes to develop it he can easily see where he failed, and prevent a like mistake next time he goes out.



Fac-simile of the check received by Mr. Gaisman.

How I Came to Invent the Autographic Kodak

By Henry J. Gaisman

THE real story of the invention of the autographic kodak dates back to the time when I first met Mr. George Eastman, a great many years ago. I had just invented and put on the market the auto-strop safety razor. About that time I met Mr. Eastman in an informal manner, and told him about the good points of my invention. Mr. Eastman was so interested that I sent him an auto-strop safety razor, he was so delighted with it that he purchased a number of the razors and gave them away to his friends.

In return Mr. Eastman gave me a very fine kodak. Up to that time I had not been interested in cameras, but the charm of photography soon asserted its sway. I began to think of ways in which the camera might be improved. It seemed to me that what the instrument lacked was some means of recording on the film itself what pictures were taken and when the exposures were made. I am not going to tell you of the long period of doubt and anxiety which followed the conception of the thought of a self-recording camera.

(Concluded on page 106)

A Huge Tesla Apparatus

A Coil With a Seven-foot Spark Gap

By Father Francois Magri, S. J.

THE great Tesla apparatus of our physical laboratory, at the College of the Immaculate Conception, Montreal, was designed by my predecessor, Father Gendreau, and was constructed by his pupils.

The current of low frequency which energizes the Tesla coil proper, is furnished by a 7-kilowatt transformer, entirely immersed in insulating oil in a glass case, which measures 27 inches in length, and 17 inches in width and height. Its primary coil is connected to the city lighting circuit of 115 volts and 60 cycles, from which it takes a current of 60 amperes. The voltage of the secondary current exceeds 65,000 volts, as is proved by the length of the spark, which has the flame-like appearance shown in one of the photographs. This secondary current passes into the primary coil of the Tesla transformer, which is connected with a condenser of 144 Leyden jars. These jars are filled with and surrounded by salt water, which takes the place of the customary metallic coatings, and which is covered by a thin layer of oil to prevent evaporation and incrustation. A rotary interrupter, driven by an electric motor, is employed in order to increase the frequency.

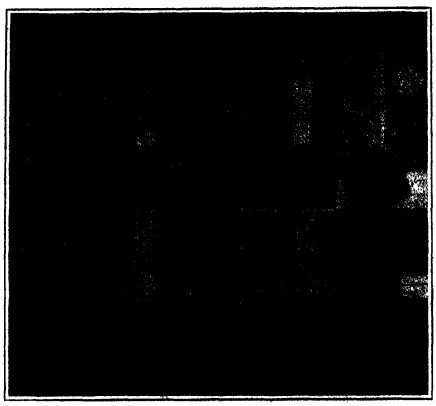
I have made important changes in the apparatus, entirely reconstructing the primary of the Tesla, and improving the insulation by mounting the wooden base on glass supports. The apparatus is more than 7 feet long. A cylindrical cage, 33 inches in diameter, composed of 12 longitudinal bars, 22 inches long, carries the primary coil, which consists of 8 turns of brass tubing, separated by intervals of 1¼ inches. The diameter of the tube is ⅜-inch, and its total length is 74 feet. Its ends are connected with the condenser and the rotary interrupter. Above this coil is a bridge, from the ends of which the secondary coil is suspended inside the primary by means of two ebonite rods 19 inches long. The secondary coil is nearly 7 feet long and more than 17 inches in diameter. It is composed of more than 1,000 turns of fine, enameled copper wire, insulated by layers of tarred paper and cloth. The maximum sparking distance is 6 feet 8 inches usually, but it has exceeded 7 feet. The spark resembles a flash of lighting and, with its deviations, attains a total length of nearly 10 feet. It produces a sound like a thunder clap that startles persons in the street, 400 feet distant. Although the apparatus is not connected either with an antenna or with the earth, the sound of the discharge is heard very distinctly through the telephonic receiver at the wireless station of the Polytechnic School, a mile and a half away, this receiver also being disconnected from its antenna and the earth.

What, then, would be the result of connecting this powerful apparatus to earth and to our experimental antenna, consisting of three wires, each 700 feet long? The discharge would certainly produce a potential difference of at least five million volts, but we have no apparatus with which this theoretical deduction can be verified.

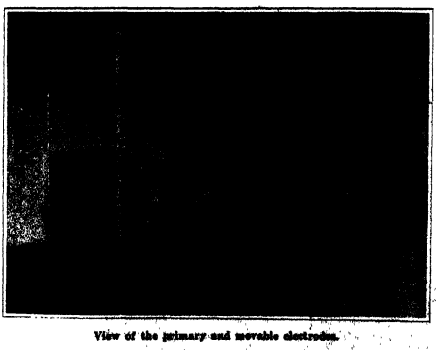
The discharge of the primary coil alone produces a deafening noise. This coil, by induction alone, heats to incandescence a 50-volt lamp, inserted in a little coil of three turns at a distance of 3½ feet. A 25-volt lamp glows brightly at the same distance, and a 12-volt lamp is heated to whiteness at a distance of 5½ feet. When the terminals of the primary are connected by a course iron wire 8 feet long, the wire is almost instantly heated to incandescence and fused. Sixteen 115-volt lamps glow white when they are connected in series between the terminals of the primary.



Discharging across a seven-foot gap.



Giant Tesla coil capable of giving a seven-foot spark.



View of the primary and movable electrodes.

A Monumental Bibliography of Science.—After a lapse of 12 years a new volume has appeared in the Catalogue of Scientific Papers, published by the Royal Society of London, viz., Vol. XIII, beginning the Fourth Series, which is to embrace all scientific papers published during the period 1884-1900, and winds up the work. This volume contains 11,551 entries of titles of papers by 2,001 authors whose names begin with A, and 51,720 entries of papers by 6,928 authors whose names begin with B; in all, 63,271 titles. In the preparation of the catalogue 1,555 serials were examined. The Royal Society Catalogue grew out of a suggestion made by Dr. Joseph Henry of the Smithsonian Institution, to the British Association in 1855, and the first volume appeared in 1867. The volumes of the first series include the literature of the years 1800-1863; those of the second, the literature of 1864-1873; and those of the third, that of 1874-1883. The fourth series will round out the century. Supplementing the volumes of the main work, in which titles of papers are arranged under authors' names, the latter being in alphabetical order in each series, a series of index-volumes is in course of publication, in which the periodical scientific literature of the whole century is grouped under appropriate subject headings. Three index volumes have appeared, viz., Pure Mathematics, Mechanics, and Physics (in two parts). There will be seventeen of these index volumes. Finally, the scientific literature since 1900 (including titles of books as well as of articles in periodicals) has been catalogued regularly in the seventeen annual volumes of the International Catalogue of Scientific Literature, which is published by the Royal Society on behalf of an international council.

The Psychology of Catching in Baseball

By Arthur Macdonald

SPECIALIZATION has developed a tribe of catchers who are clumsy on their feet, usually weak at the bat, poor base runners, and of very little value when sent to other positions. Yet the catcher has a most important position, as director and transmitter of signals. Good fielders and hard hitters there are who are not quick-witted, but never a catcher, who is the first to see signs of weakness in the pitcher, and sends word to the bench for another pitcher to warm up. Three years' experience with a major league is regarded as necessary to make a catcher competent. Only a few continue long enough to have such experience.

Good catchers say that when they hear the ball *touch* the bat their hands instantly fly toward the ball, no matter where it glances off the bat. Some after losing sight of a fly in the sun have the ability to reach it nevertheless.

Sometimes catchers are unjustly blamed for not putting a runner out who gets a big lead off the pitcher (who is really at fault). Here not only a good throw will fail, but it is often useless to throw at all.

Good Catchers Make Many Unexpected Throws.—The catcher must throw from an unnatural position, and with a jerky motion of the arm. Archer threw with a snap of the arm while standing flat-footed and put many out on first base.

The catcher signals second baseman that he is going to throw the next pitched ball to him; the pitcher delivers it a little to one side, so that it can be handled easily; the shortstop knows the next ball will not be hit, and so can back up second base. This unexpected throw often puts the runner out on second. A similar play is when the runners move up every time the ball is pitched. If those on second and third both get well off the bags, the catcher again signals the pitcher to waste a ball, and makes as if he were going to throw to third, but instead, throws quickly to second and retires the runner there. Or makes as if he were going to throw to second, but instead, throws just beyond the pitcher when the baseman starts for second, and he, without stopping, runs up, catches the ball and sends it home to retire the man seeking to score.—Abstracted from *American Physical Education Review*.

A Wireless Tractor

Extensive use of really new in traction engines is unfortunately necessary, since tractors have become fairly well standardized and many of the odd types described in previous issues of the SCIENTIFIC AMERICAN have failed of commercial success.

The accompanying illustration, however, seems to show a brand new departure from the caterpillar, or endless track, type which has become well established in this country.

Previous models of endless track machines have had a three-point support, in that a front wheel or track was used. In this tractor the entire weight is borne upon the two tracks, each of which has a bearing surface 80 inches long in contact with the ground.

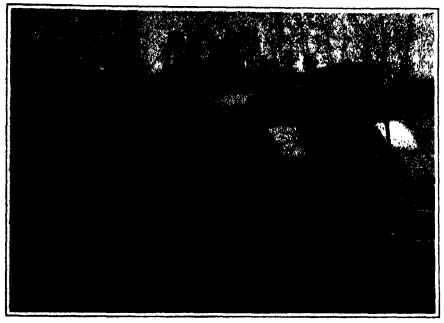
Two widths of track are provided—13 and 30-inch, giving, respectively, 2,080 and 4,800 square inches of bearing surface. This reduces the pressure per square inch to 5.77 pounds for the 13-inch track and 2.8 pounds for the 30-inch track. A 1,200-pound horse, wearing a No. 4 shoe, exerts a pressure of about 21½ pounds to the inch in pulling, and a 170-pound man, with a No. 8 shoe, about 9½ pounds. Hence this tractor is expected to work even under extreme conditions of snow, mud, or ice.

Steering is accomplished quickly and easily by two foot-pedals, each of which governs one of the independently driven tracks. By slowing up or stopping one track, the other is made to do the driving, with a very short turn as a result. Without a trailer, the tractor turns in a 12½-foot circle, outside measurement.

The long track is carried on a jointed truck, allowing it to adapt itself to uneven ground. On the narrower track unit a single steel casting takes the place of a built-up shoe and links. There are twenty-five units in each track. The tractor is moved forward by a sprocket meshing with the joints of the track, which lies stationary upon the ground as the truck wheels carrying the weight of the tractor roll over it.

A 6 by 7-inch 4-cylinder motor is used, delivering 20 horse-power at the drawbar. Two speed, 2½ and 3½ miles, both forward and reverse, and a belt pulley for stationary work are features.

The majority of these tractors sold are engaged in reclamation work in Louisiana. However, in spite of the higher cost, it is expected that they will become popular in general farm work, being especially adapted to use in small, fenced fields, and on land in a high state of tillage. There is even a prospect of successful use in cultivating cotton and corn, as the tractor can straddle rows until the plants reach a considerable height. Partial arrangements have been made for a trial in metropolitan street-cleaning work after the first heavy snowfall of next winter, and further fields in irrigation and road-building work are opened by this unique construction.

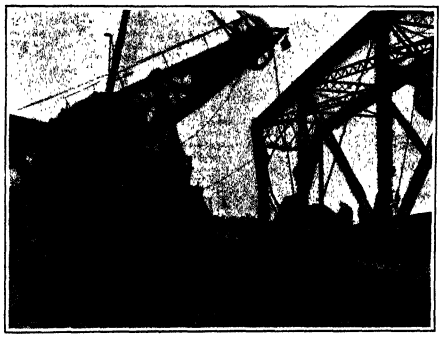


A new type of small caterpillar tractor.

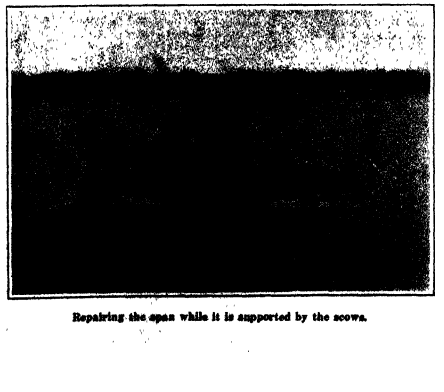
Raising a Wrecked Bridge With Dredges

A STEAMER entered the Maumee River at Toledo recently, towing a 360-foot steel barge. A railway bridge was passed without trouble, but while going through the draw of the Wheeling and Lake Erie bridge, the barge slewed over sharply. Although the steamer cast off the tow line, the steel barge struck the bridge and wrecked the span.

The span measured 177 feet and weighed 210 tons, but it was readily raised and reseated by means of two dipper dredges with a rated hoisting capacity of about ninety-five tons. Hoisting tackle was attached to the booms of the two dredges and made fast to the lower chord of the span at the third panel from the end. Then the hoisting engines of the dredges were operated to lift the end of the span out of the water, and a water ballasted scow was placed under the span as near the end as possible, and blocked up to take a bearing against it. When the water was pumped out the scow raised the span high enough to permit of placing a second scow under the end. The span was then raised a little high enough to be pulled back into the masonry, false work being placed under the end of the bridge, and the damaged steel work repaired where necessary.



Raising the span with two dipper dredges.



Repairing the span while it is supported by the scows.

The Hardening of Soft Fats and Oils

IT was recently reported in trade circles that a German firm had secured a patent for hardening whale-oil. This has again called attention to that most important problem—How can soft fats and oils be hardened? At last it may be said that an answer has been found to the riddle, thanks to the unifying researches of Prof. Sabatier of Paris and Dr. Normann.

For a very long time past chemists have been devoting their endeavors to increasing the melting point of liquid fats to such a degree that they would remain solid at all ordinary temperatures. The actual difference between a solid and a liquid fat is really very slight; both in common are composed of carbon, oxygen, and hydrogen, but the percentage of hydrogen is less in oils than in solid fats. Hence the point at issue was to supply liquid fats, or oils, with the missing hydrogen.

It was a well-known fact that certain metals (as, for instance, platinum when finely pulverized or drawn to form extremely fine wires) possess the peculiarity, when in a freshly refined form, of absorbing gases, and more especially hydrogen, in large quantities which are again given off under favorable conditions. Now Prof. Sabatier discovered that if finely broken up metals (such as platinum palladium, and nickel) be combined with hydrogen and other substances capable of absorbing hydrogen chemically, then the process will actually take place. From this it was easy to assume that first of all the metal takes up the gas, in order to transfer it at once to the body or bodies capable of absorbing it. To Dr. Normann the credit is due of first applying this new process to oils, fats, and blubbers.

In this way it has now become possible to harden a cheap raw material, in other words it can be transformed into a substance of higher value. Fish-oil cannot only be hardened, but it also loses its unpleasant smell and taste, and the hardened product resembles snow-white odorless and tasteless beef-suet. Olive oil, rape-oil, groundnut oil, etc., can also be transformed by this new process into a solid practically flavorless and aromaless tallow. Castor-oil becomes a hard, brittle body, which can be crushed and ground just like sugar. There is, however, still another point to be solved by chemists, viz., the transformation of non-saponifying substances into such as are capable of saponification, whereby a vast field of utility would be opened up to petroleum and, should it ever become possible to change petroleum into a sebacic acid from which a good odorless soap could be made, then a wide field of profit is opened up to the industrial world. In the very first place a marked drop in the prices of soaps in general would be induced.

For the time being the Sabatier-Normann process will prove of special value to the whale-oil industry. Just at the same time when this invention was perfected, fresh hunting grounds for whales have been found in the Southern Polar Seas, and the catches are already exceeding the most sanguine hopes. In Norway, the home of whale fishers, whale fishing companies sprang out of the earth like mushrooms, and the capital at present invested in the industry is valued at 100 million crowns. According to the last returns 800,000 casks of whale-oil were produced in one year, as a full-grown whale only gives 20 casks of oil, under the most favorable conditions, this means to say that about 40,000 whales are killed every year. As these creatures breed very slowly, it is feared that, should this slaughter be long continued, the whale will ultimately die out, and the government interested now propose to lay down laws regulating the killing of these mammals. The fact that, for the reasons above stated, any flooding of the market with whale-oil is out of the question, is of special interest to all enterprises handling raw oils, because they perceive a serious competitive product in the hardened whale-oil made by the Sabatier Normann process. On the other hand it will give a great fillip to the cultivation of oil producing seeds and trees in the tropics.

Seeing by Wire

DEPUTY CONSUL-GENERAL CARL E. LOOP of London reports that Dr. Archibald M. Low, a London consulting engineer, claims to have discovered a novel method for transmitting light by wire, the contrivance including a transmitter, a receiver, and a connecting wire, with the transmitter a screen divided into a large number of selenium cells whose electrical resistance varies according to the light striking it. A synchronously running roller is passed over the screen and includes a number of alternating conductors and insulators, a motor driving the roller at a high speed. The invention is referred to by the inventor as a kinematographic application of common electrical principles, and while it has been tested to the equivalent of four miles, the inventor sees no reason why it should not be effective for greater distances.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Electrical Devices.

ADVERTISING MACHINE—P C SCOTT, 5017 Nicholas St., Dundee, Nebr. This advertising machine is adapted for use in street cars and the like. It comprises a curtain or band having a series of advertisements on one face and a mechanism provided for moving this band in such manner that the advertisements will be displayed in sequence each being present to view and held in fixed position for a predetermined length of time and then moved out of position, to give space to the succeeding advertisement. It contains means for reversing the direction of movement of the belt near each end of its travel.

Of General Interest.

FIREPROOF PARTITION.—M DAWSON, 702 San Fernando Bldg., Los Angeles, Cal. Mr Dawson's invention is a fireproof partition especially adapted for use in crowded office buildings where the space requirements are exceedingly severe, so that the partition must be made very thin, without undue sacrifice of other desirable characteristics

LIFE PRESERVER—D LYMAN Twin Falls, Idaho This invention relates to life-saving apparatus, and more particularly to a suit to be worn in the water by those unable to swim, and is adapted to permit of unobstructed use of the limbs of the wearer and of his eyes nose and mouth, and to exclude water from his per-



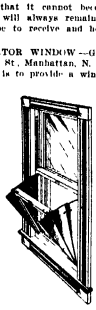
LIFE PRESERVER

son and protect him from floating obstacles and wreckage. One or more pockets may be provided in the suit for the reception of certain necessary articles, including a bottle of fresh water, a small supply of condensed food, and a flashlamp.

SHIPPING PACKAGE—H. THOMPSON, care of Windsor Mfg Co., Windsor, Mo. This improvement has reference to shipping packages, and especially packages for shipping household brooms, and it has for its object the provision of a package that is reasonable in cost, efficient in preserving its contents, and simple in structure When the package is ready for shipment it is dust and moisture proof, so that the brooms are fully protected

SANITARY SHIELD—JULIA C KEPPER, 22 N Raleigh Ave., Atlantic City, N. J The shield has a receptacle for receiving discharges and means for supporting the receptacle in proper position, and for permitting the said support and means for connecting the support to the receptacle to be adjusted to fit the body of the wearer wherein the receptacle may be easily cleaned, and wherein the receptacle is so shaped that it cannot become folded or rolled, but will always remain open and in proper shape to receive and hold all of the discharges

VENTILATOR WINDOW—G B ROBERTS, 170 E 77th St., Manhattan, N. Y., N Y The object here is to provide a window sash that



VENTILATOR WINDOW

can be used in school rooms and other public places, for the purpose of permitting the entrance into the room of a sufficient supply of fresh air and without producing a direct draft or in any other way subjecting the occupants to inconvenience, discomfort, or danger of sickness.

CARRIER OR CONVEYER.—L. RASSEL-MUSCH, 1026 Arch St., Philadelphia, Pa. This carrier or conveyer receives, holds, retains, and may be adjusted to any length of rod or bar made of wood or metal, and the carrier or conveyer is so constructed that, by its novel construction, a rod, bar, window shade, or map may be immediately attached to it, be retained by it, and firmly and securely held in place.

SAFETY DEVICE FOR SHIPS.—A H. MATTHEW and JESSIE B. PROUTY, Colville, Wash This invention relates to brake wings carried by the vessel to normally lie close against the sides thereof, and adapted to swing outward to impede the movement of the vessel. It comprises novel means for controlling the wings, to release and position them for braking action, and to fold them into inoperative positions.

HOLDER AND DELIVERER FOR DRINKING STRAWS.—H M HAY, Colorado Springs, Col. This invention has reference more particularly to positive discharging or distributing means for the straws, whereby they are dis charged singly, the device being designed to be easily manipulated by an attendant or person desiring to obtain one of the straws.

FOUNTAIN SYRINGE PRESSURE CLAMP.—M J. RABAT, 2121 86th St., Brooklyn, N. Y. Mr. Rabat has invented a clamp which, when applied to the surface of the bag, will increase the impinging force of the stream of a suspended bag, and will create pressure on a bag not suspended, which would be very convenient during voyages, or when there is no convenient means for the suspension of the fountain syringe. The clamp is for use on fountain syringes of the flexible bag type, and comprises two hinged plates, having a pivoted arm, coacting with a cam associated with said plates.

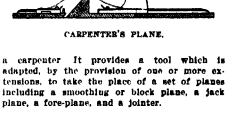
SHIPPING CRATE.—H. B KOPF, P O Box 1238, New Haven, Conn. This invention relates to means for packing and shipping various articles of a perishable or breakable nature, so as to provide a separate chamber or compartment for each article, whereby it may be properly protected from contact with a rigid wall or with an adjacent article

POCKET CLIP FOR RETAINING ARTICLES—W L HOFFMAN, 5 Wayne St., Jersey City, N J This invention refers to articles handers, and more particularly to a pocket clip for retaining articles in a pocket, although the device may be used for other purposes It provides an extremely simple and effective article-retaining device, conveniently manipulated for applying or removing the articles, which is efficient and reliable in use

Hardware and Tools.

NON-SHORT-CIRCUITING PICK.—N LIPOFF, 23 Brown St. Flemington, N J. This invention relates more particularly to picks adapted for use in electrical railroad construction or other work in which danger exists in the use of the common pick in causing short-circuiting or grounding of the current This is obviated by a multi part pick which embodies two sections including a point or digger and a tamper, each having sleeve portions attached to the handle in a novel manner, with insulation between the sections for the purpose of electrically separating the same

PLANE.—J SMITH, P O Box 4, Pooler, Ga. This invention relates to woodworking tools and has particular reference to the construction of carpenters' planes, whereby the tool may be adjusted or modified in size and thereby made to serve as a substitute for several different sizes of planes commonly required by



CARPENTER'S PLANE.

a carpenter It provides a tool which is adapted, by the provision of one or more extensions, to take the place of a set of planes including a smoothing or block plane, a jack plane, a fore-plane, and a jointer.

Heating and Lighting.

PORTABLE RADIATOR HEATER.—M. LEWLESS, Brooklyn, New York, N. Y. This invention comprehends the provision of a portable radiator heater, the device being adapted to receive any improved form of radiator having suitable means for supplying water thereto, and carrying a burner for heating the water or generating steam for heating purposes.

LANTERN.—J. BARTON, J. MELBOURN, F. NEEDHAM and J. G. GREEN, Cle Elum, Wash. Address J. C. Gleyateen, care of Short & Gleysteen, same place This invention relates more especially to lanterns of the kind used in connection with acetylene gas, the more particular purpose being to provide a construction in which the water tank and the carbid container, associated with the making of the gas, are connected together by the drop pipe, and removable as a unit for purposes of lighting the lamp

ACETYLENE GAS GENERATOR.—A. M. SALAZAR, care of Brazilian Consul, 17 State St., New York, N. Y. This invention relates to acetylene gas generators, and has reference more particularly to gas generators for incandescent burners comprising a gas-generating chamber having means balancing the chamber pressure, and feeding means for the chamber controlled by the pressure balancing means. In the gas generator the gas pressure is balanced by a hydrostatic head controlling the feed of carbid to the gas chamber.

DRAFT REGULATOR.—A. H. MARMENKE, New York, N. Y. This invention relates to a novel draft regulator for low-pressure steam boilers, more particularly used for heating purposes, the construction being such that a delicate regulation will be automatically effected and maintained, even after prolonged use.

Machines and Mechanical Devices.

CUTTING ATTACHMENT FOR SEWING MACHINES.—G W. PARKINSON and B. S. TOMPKINS, Beacon City, N. Y. Address Louis H. Stotesbury, 55 Liberty St., New York. N. Y This invention provides an attachment for sewing machines, more especially designed for accurately cutting the welt on the brim of a felt hat during the time the welt is stitched in place and while a stiffening wire may be inserted in the welt.

CABLE EXCAVATOR.—A. D. HADSELL, care of Cable Excavator Co., 410 Arcade Bldg., Philadelphia, Pa. This invention relates to excavators of the aerial type and has particular reference to improved means for facilitating the loading, transporting, and dumping operations, all from a main power station at one end of the line of excavation.

RECORDER.—E. SCHMICH, 25 Hieslstrasse, Munich, Bavaria, Germany This recorder is more especially designed for use in connection with lifting machines, block presses, bending presses, forging machines, etc., and arranged to furnish a permanent record of the quality and quantity of the work and the work done by the machine and workmen, at the same time enabling the workmen to accurately apply the pressure of the machine for a predetermined period of time

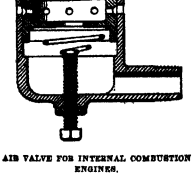
WASHBOILER.—A. GRUENSTERN, R No 3, Marion, Wis. The purpose in this instance is to provide a boiler wherein means is provided for cleansing clothing mechanically by the circulation of liquid holding in solution a cleansing medium The improved mechanism may be made of any desired shape to fit any form of boiler

LOOM ATTACHMENT.—I CORLOMBE, 53 Riverview St., Fall River, Mass. The intention here is to provide an attachment wherein the tension on the warp beam is controlled directly by the weight of the yarn on the beam, and wherein the mechanism is so arranged that as the yarn feeds from the beam, the tension will automatically decrease

Prime Movers and Their Accessories.

ENGINE.—G. PROCHAZKA, 6610 19th Ave., Brooklyn, N. Y. More specifically this invention relates to a rotary engine having a main rotor provided with a motive fluid chamber, a secondary rotor movable with the main rotor and eccentric with respect thereto, so as to vary the capacity of the motive-fluid chamber and adapt it the same to act as a compression chamber, and a turbine element adapted to receive motive fluid under compression from the motive fluid chamber.

AIR VALVE FOR INTERNAL COMBUSTION ENGINES.—A. G. GARRETT, Statenville, Ga. The purpose of this invention is to provide a valve to be connected with internal combustion engines and preferably mounted upon the manifold pipe of the engine for con-



AIR VALVE FOR INTERNAL COMBUSTION ENGINES.

trolling or at least modifying the air supply. The valve is made automatic in its action and controlled by the degree of vacuum obtaining in the manifold pipe so as to increase the air supply as the vacuum diminishes and to diminish the air supply as the vacuum increases.

Railways and Their Accessories.

RAILWAY TIE AND RAIL FASTENER.—H. A. ESBENSEN, St. Croix Falls, Wis. This invention provides fastening means involving simple implements that will not be liable to become loose as are rail spikes of the usual form; provides a fastening means that may be quickly and conveniently applied to the rails and ties, and as readily removed when required, and provides a fastening means having the required strength to withstand the strains of use, while at the same time involving a minimum cost.

Pertaining to Recreation.

LAWN GAME.—J. [illegible] 760 E. 180th St., Bronx, N. Y., N. Y. The present object here is accomplished in the provision of a lawn game commonly known as the "Lawnita," which the same consists of a projecting apparatus having means for anchoring the same to the ground, such apparatus being provided mounted so as to be adjusted at different inclinations, whereby balls designed for use with the apparatus may be projected at different elevations and distances therefrom.

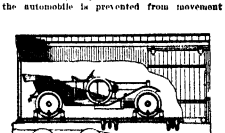
Pertaining to Vehicles.

BRAKE OPERATING DEVICE.—E. E. PUR, Marlington, W. Va. An object here is to provide a device which will positively hold the brake in its operative position, but which may be easily moved to release the same with a minimum effort Further, to provide a removable lever which may be taken out when the wagon is being loaded, and which may be replaced when the loading is finished, thereby facilitating the loading operation.

TRACTOR.—H. MANN, Woldon, Ill. This invention relates to tractors, and more particularly to an improved construction of pilot or guide wheels for tractors or other machines of a similar nature It provides a pilot wheel which may be driven by the propelling means of the machine and at the same time be turned in any direction for guiding the tractor It also provides a pilot wheel which may be reversed

GARAGE.—J A VARIAN, 76 Ward St., Norwalk, Conn. This invention provides for installing or removing cars without collisions and the like, and also for obviating the necessity of an extensive building construction which is now necessary, due to the fact that the floor spaces are left generally clear but weakened by reason of the bridging of the full width or area of the garage by floor beams, while the present invention permits of a maximum amount of storage space and weight to be supported within a predetermined area.

AUTOMOBILE ATTACHMENT.—E. F. MARTIN, Buras P. O., La. This attachment is adapted for use in freight cars, and the invention provides mechanism in connection with a railroad freight car for supporting automobiles during shipment, in such manner that the automobile is prevented from movement



AUTOMOBILE ATTACHMENT.

either longitudinally or laterally with respect to the car and is firmly clasped to the car, and wherein the mechanism is so arranged that it may be moved into or out of operative position, and beneath the level of the floor of the car to prevent interference with other freight when the car is used for other purposes.

Designs.

DESIGN FOR AN EMBLEM OR BADGE.—G. E NERNEY, Address The Charles M. Robins Co., Attleboro, Mass This ornamental design comprises a heart within which is placed the head of a moose. Attached to the heart is a conventional ribbon bearing the legend "Mooseheart"

DESIGN FOR A BUTTON.—J F. BYRNE, care of City Button Works, 374 Second Ave., New York, N. Y. In this ornamental design for a button the article is of oblong shape, and its plan view, side elevation, and end presentation show a button of attractive and graceful lines

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NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper

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Inquiry No. 9275 Wanted the name and address of the manufacturer of a spar shoe fastener, invented especially for shoes and other articles.

Inquiry No. 9276 Wanted, the name and address of a manufacturer making clock-work mechanism for running window display machines as employed by safety razor manufacturers.

Inquiry No. 9277. Wanted, the names and addresses of factories making farm implements for export.

Inquiry No 9278 Wanted, the name and address of a manufacturer of smooth metal mirror frames, such as are sold in 5 and 10 cent stores, with a mirror and a cardboard back.

Inquiry No. 9279. Wanted, meteorites—information desired concerning available specimens.

Inquiry No 9280 Wanted the name and address of a manufacturer of burners and blades for gas-heated sad iron.

Inquiry No. 9281 Wanted the name and address of manufacturers of vacuum adhesive hangers or other appliances for hanging cards, frames, charts, etc., to walls of buildings.

Inquiry No 9282. Wanted the name and address of a manufacturer who can make a large quantity of sugar bowls with trade marks incorporated therein.

Inquiry No 9283 Wanted the name and address of a manufacturer who can make clock movements suitable for fly traps. They must be reliable at low cost and must operate a belt for a period of from two to four hours.

Inquiry No. 9284. Wanted the name and address of a Company that can manufacture combined toothpick and toothbrush made of special wood

Inquiry No 9285 Wanted the names and addresses of manufacturers of machines used for perforating music rolls for automatic piano

Technical Schools

READERS' SERVICE—Hardly a week passes but the Editor receives letters from readers of the Scientific American who ask him whether they shall send their boys to a technical school. Whether a boy shall become an engineer, a chemist or a naval architect are questions that puzzle parents. The Editor will be pleased to aid readers of the Scientific American in deciding the matter of technical education for their sons. Address, Educational Bureau.

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Measuring a Racing Yacht

(Concluded from page 100.)

place at the stern, and the sums of these distances subtracted from the overall length on the deck gives the actual load waterline. For ordinary American racing yachts the load waterline plane is established each season and permanently marked at bow and stern and on each side of the yacht near the point of greatest breadth, this plane being as nearly as possible the plane of flotation when in racing trim.

The displacement is obtained either by weighing the yacht or by a computation where the load waterline is divided into ten equal parts, and the area of the immersed cross-sections found in square feet. From these areas and the load waterline length the displacement in cubic feet is calculated by a formula known as Simpson's rule. For determining the quarter-beam length a large floating Y-shaped wood caliper is used to measure the overhang.

The draft also of a racing yacht always must be considered, as any excess over a fixed limit is penalized. This limit is taken at 16 per cent of the load waterline plus 1.75, and any excess of draft exclusive of the centerboard as obtained by this calculation is to be multiplied by 3 and added to the rating. There is no limit to the actual displacement of a yacht, according to the rules, but the cube root of the displacement factor D as used in the measurement formula must never exceed 20 per cent of the load waterline plus 0.50. If the actual displacement is smaller than that allowed by this limit, the actual displacement is used in determining the measuring, but if the actual displacement is greater, then the limiting value of the cube root of D is employed.

The measurer not only is concerned with the hull, but, as will be seen by further reference to the original formula, with the area of the sails obtained from actual measurements, both of them and of the spars. The data he must secure in such measurements will be apparent by reference to the accompanying diagram. In measuring the mainsail and topsails of sloops, schooners, and yawls and mizzen and topsails of three-masted schooners, etc., he must obtain B, the length of boom measured from after side of mast to outboard end; G, the length of gaff when lying on top of the boom, measured from the afterside of mast to outboard end; P, a perpendicular to be measured along the afterside of the mast from the top of the highest sheave in the mast or topmast, or from the juncture of the mast or topmast with the eyebolt or pennant of the highest halyard block, to the upper side of the boom when touching the upper part of the goose-neck; H, a perpendicular to be measured along the afterside of the mast from the upper side of the boom, when touching the upper part of the goose-neck, to the lower edge of a black band, at least 1 inch in width, upon the mast, above which mark the throat cringle of the mainsail shall not be hoisted; D, the diagonal, which is calculated as follows

$$D = 0.96\sqrt{B^2 + H^2}$$

and T, the length of the leech of the working topsail or jib-header, to be measured from the sail when dry and stretched hard taut.

The mainsail area is obtained from the above measurements by multiplying the length of bottom by the perpendicular height, and to the product adding the length of gaff multiplied by the diagonal, the sum being divided by two, expressed in a formula as follows:

$$\frac{B \times H + G \times D}{2}$$

To obtain the area of the working topsail or jib-header, the area of a triangle whose three sides are G, $P-H$, and T is included, while in pole-masted vessels carrying sprit topsails, the length from the highest point of the sprit to the upper point of measurement of H shall be used instead of $P-H$ in computing the area of the topsail.

To determine the area of the headsails, the quantities required are J, the distance from the foreside of the mast to where

The Quest of Cold Light

Talks about MAZDA No. 5

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SWITCH on the current that causes an electric incandescent lamp to glow. What happens? You get light, but also heat. Since your eye is a special instrument particularly sensitive to light, since you read a book with light and not with heat, the more light that you get from your lamp the more satisfactory should be the result in every way. A light which is brilliant but *cold* would represent the ideal of efficiency.

Whether or not this ideal is reached, the incandescent electric lamp will grow steadily colder, steadily more efficient, thanks to the Research Laboratories of the General Electric Company at Schenectady.

In these laboratories a corps of picked men, each an expert in some phase of illumination, men who are in communication with the foremost European investigators of light, are constantly at work. After many months of patient experimenting the art of drawing tungsten into a delicate wire was developed in these laboratories. Thus it became possible to make the new filament which glows in the MAZDA lamp of today and which has supplanted the old carbon filament because three times as much light can be obtained for a given amount of current.

The Research Laboratories of the General Electric Company represent almost every branch of technical knowledge—chemistry, metallurgy, physiology, psychology, physics, microscopy, engineering, optics.

In these laboratories scientists conduct many researches along advanced theoretical lines. What is the secret of the phosphorescent glow that emanates from certain marine animals and decaying organic matter?

Why can the glow-worm shine in your hand and never burn your skin? What is the exact color of daylight? Is the best artificial light a miniature sun or a body with a brilliancy not so white? Scores of such problems must be attacked in the quest of the ideal light.

But even more important commercially is research that gives promise of immediate results. Suppose that chemists, for example, discover a way of preparing an element so that it is able to yield much light without breaking down readily under the electric current. Their discovery may mean the birth of a new lamp, or it may come to naught. It must be subjected to critical study by other scientists. The physicist steps in with his analytical instruments to discover how much of the glow that comes from the new material is light and how much is heat, in other words, how much more efficient is the new material than anything thus far discovered; he estimates what is the candle power of the new material for a measured amount of current, he devises better physical conditions for the material to perform its function. Next, the microscopist, perhaps, studies it to learn how it withstands the *pitting* and the *scoring* action of the current.

Thus the new material is passed through successive laboratories, from scientist to scientist, from engineer to engineer. If the discovery proves to be of commercial importance the General Electric Company transmits it to its own lamp manufacturing centers at Cleveland and Harrison and to other companies entitled to learn of it.

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Because the work of the Research Laboratories is never ended, MAZDA Service is continuous. As new discoveries are made that bring us a little nearer the ideal cold light they will be applied in making new lamps, which like their predecessors will be marked MAZDA. Hence MAZDA will always be found on the latest lamps evolved by MAZDA Service—a lamp in which the best scientific thought of the time is embodied.

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the foremost edge of the sail cuts the bowsprit, and P_0, a perpendicular measured along the forward side of the mast from the top of the highest sheave to the deck. The spinnaker boom is measured when in position, and at right angles to the center line of the boat from its outboard end to the center of the mast, and this length in yachts over 31 feet rating is limited to base J of the fore-triangle, and in yachts 31 feet rating and under by 40 per cent of the entire base line determined by the sum of H plus J plus the diameter of the mast at the boom goose-neck in the case of single-masted yachts. Any excess in length of the spinnaker boom over the above limits must be added to the base J of the fore-triangle when computing the area of the headsails. The area of the headsails is determined by multiplying the base of the fore-triangle J by the perpendicular altitude P_0, dividing the product by 2 and taking 85 per cent of the result. The total area for the use in the measurement formula is obtained by adding the area of the mainsails, topsails, and headsails; certain modifications applying to yawls and schooners. The excess of area of a club-sail over that of the working topsail is not considered unless it exceeds 150 per cent of the area of the latter

Rating as obtained by the measurement formula not only gives the classifications of the yacht and indicates the class in which it is entitled to race, but also furnishes a basis for computing the time allowance. The time allowance depends upon the fundamental assumption that a yacht of rating measurement R will sail one nautical mile in the number of seconds given by the formula

$$\frac{2160}{\sqrt{R}} + 183.62$$

Accordingly, the allowance per mile between yachts of different ratings r and R will be given by the formula

$$\frac{2160}{\sqrt{r}} - \frac{2160}{\sqrt{R}}$$

From this, there has been worked out an elaborate series of tables which indicate the amount of time allowance that one yacht shall give to another based on the rating in feet and decimals of feet.

The theory of yacht rating and measurement is to secure absolute equality between vessels of different sizes and to encourage the best possible design which supplies serviceable and seaworthy boats rather than racing machines.

When there comes an important series of competitions, such as those for the "America" cup, the fundamental rules of rating and measurement obtain a new importance, and while they may be modified as regards changing the trim during the season of racing, and in other minor respects, yet they apply essentially as outlined above.

New Facts About Parasites

ZOOLOGISTS have often called attention to the fact that similar animals have parasites of neighboring species, and that the resemblance of parasites can be concluded from resemblance of the animals upon which they live, a well-known example being that of the anthropoids and man. M. Fischer, professor of botany at the Berne University, shows that the same relation is true for the case of plants. Correct results, however, are obtained by observing what can be called the true parasites, for animals as well as plants, those being the ones that never leave the specimens, and which are adapted to special conditions of life. Among the vegetable parasites, the spores known as Urédinés follow this rule, and they have never been cultivated with success except upon the particular plant which harbors them. He shows that on one hand the forms which are related to the Urédinés live almost exclusively upon the representatives of the same family, and on the other that species resembling this group (Urédinés) live only on closely-related plants of the same genus or species. Thus the parasite forms of the genus *Ascoschifa* live upon leguminous plants, with few exceptions. Nearly all the species of the genus *Gymno sporangium* live upon the conifers and the *Rosaceæ*. Several species of the genus Puccinia all live upon the Compositæ. One of them, the *Puccinia Hieracii*, even shows a marked specialization, and has two forms, one of which lives upon the Hieraciums of the sub-genus Pilosella and the other upon those of the sub-genus *Eubieracium*. Other cases might be noted, and show a marked specialisation. But it does not always follow that each time the parasites resemble each other the same is true for the harboring specimens, and his researches show some wide divergences which lead us to avoid making this a too general rule.

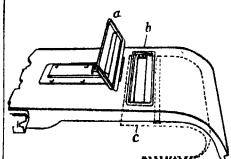
How I Came to Invent the Autographic Kodak

(Concluded from page 101.)

The actual mechanical part, that is, the small door giving access to the film, was comparatively easy, but the paper covering for the film kept me pretty earnestly employed for almost three years.

It was necessary to find a coating for the paper which could be completely showed out of the way as the stylus passed through, giving a free access to the light. I may say that experts said it could not be done, but I persisted and eventually discovered a waxy compound impervious to moisture or to climatic influences, with which to coat my paper.

The invention was then ready to offer to Mr. Eastman. Mr. Eastman saw the possibilities of it at once, and he requested time in which to have a search made, not only in the United States, but in Germany, France, and England as well. This was necessary in order to demonstrate that



The door *a* normally covers the slot *b*, through which the writing is done. In order to provide a firm support, the camera frame *c* is utilized, part of which frame constitutes a table. The film passes over a roller and over this frame (table). The door *a* is held by a slidable latch. By pushing the latch back the door springs open in a slot formed in the door a steel stylus is lodged, the latch holding it in place when the door is closed. When the latch is pushed back and the door flies open, the stylus drops out ready for use

no patent had been taken out on a like invention.

After a most exhaustive search the experts in the Patent Offices in all four countries admitted that the patent was a basic one. I should like to say that during this long period of waiting Mr. Eastman's attitude toward me was that of friendship and of solicitation that I receive the full reward for my invention. In fact, I cannot make it too plain that Mr. Eastman's attitude throughout the entire transaction was of the greatest courtesy toward myself.

Mr. Eastman and I had a long talk after it had been settled that the Eastman Kodak Company was to take over the invention, and the suggestion was made that I accept a royalty. This was perfectly agreeable to me, but later on circumstances arose which made it desirable that the Eastman Kodak Company possess exclusive rights to the patent. Mr. Eastman thereupon offered me $300,000 for my rights in the patent. I considered the matter carefully, and two days later received a check for the amount.

I am, of course, glad to have $300,000. What man is not? I am also glad that the entire matter is adjusted so that I can turn my mind to new inventions, but I can truthfully say that ahead of the financial gain is the memory of the friendship, courtesy and good will of Mr. George Eastman. From the first he aided me in every way possible, and in my heart I think he was more than just.

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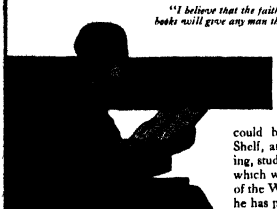
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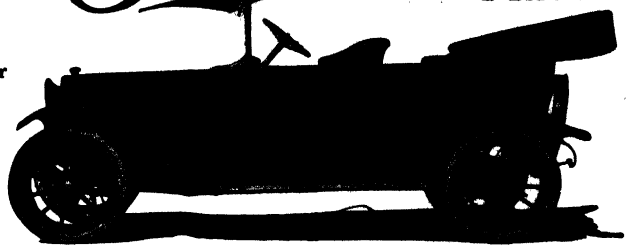
THE DRAMATIC MIRROR CO 146 West 45th Street New York City

The New Studebaker Automobiles

Six—5-Passenger
$1385
In Canada $1750

7-Passenger $1450
In Canada $1875

All Prices F. O. B. Detroit or Walkerville



The New FOUR

Touring Car and Roadster

The net result of the improvements itemized in the specifications printed herewith is:

More Power;
Less Weight;
Greater Strength,
Increased Economy;
More Room;
Added Comfort;
Greater Beauty.

Specifications

Two Body Styles: Five-Passenger Touring; Three-Passenger Roadster
Wheelbase—108 inches.
Long-Stroke (5-inch), Small Bore (3½-inch) Motor; Four Cylinders, en Bloc, Exhaust Manifold Cast Separate.
Smokeless, Non-Leaking Lubrication System.
Larger Valve Openings
Pressed Steel Push-Rods.
Annular Piston Rings
Tabular Radiator with Auxiliary Water Tank.
Crowned Fenders
Special, Dimming Headlights.
100 Pounds Lighter
12 x 2½ in. Brakes.
Hot-Jacketed Schebler Carburetor Bolted to Cylinders.
Magnetic, Non-Leaking Gasoline Gauge, the Only One Approved by Insurance Underwriters.
Generous Footroom in both Compartments
33 x 4 in. Goodrich Tires on Q D Demountable Rims; Safety Tread on Rear.
One-Man Type Top.
Built-in Rain and Clear Vision Ventilating Windshield, Attaching Rigidly to Top.
Full Floating Rear Axle, Shaft Locking into Taper at Hub
Full Equipment of 13 Timken Roller Bearings.
Irreversible Steering.
Flush Dash Equipment.
Extra Rim and Carrier
24 Finishing Operations in Painting Bodies Studebaker Blue
The Simplest and Most Accessible Motor in America.

THE new Studebaker cars are now being shown in more than five thousand cities, the world over—

In our judgment these new Studebakers place every other "Six" and every other "Four" on the defensive—

Studebaker cars are manufactured practically complete in Studebaker factories—more nearly so we believe, than can be said of any other car.

They carry only one profit—that of the legitimate manufacturer.

And it is this one profit idea of manufacturing together with the vast volume of the Studebaker output that is responsible for the truly remarkable value that you find in Studebaker cars.

Verify these statements for yourself—by careful and immediate inspection of the new Studebaker models.

Proof of Studebaker Value

Eighty companies in the United States sell Automobiles.

Only ten of them manufacture the majority of parts in their cars

Of these, we believe Studebaker makes the greatest proportion of parts.

We make all our castings, springs and forgings.

We heat-treat our gears and forged parts.

We make our aprons, hoods, fenders and other stamped parts.

We make the bodies and tops.

Except tires, electrical equipment, Timken bearings, carburetors and a few minor items, we manufacture—in our own factories—all parts of Studebaker cars.

Being complete manufacturers, we are able to build better cars, and to put better value into our cars, at a stated price

STUDEBAKER, Detroit
Canadian Plant, Walkerville, Ont.

The New SIX

5-Passenger and 7-Passenger

The elements of greater value listed in the specifications printed below result in:

150 pounds reduction in weight, with increased strength;

Even greater gasoline economy;

Increased tire economy;

Increased ease of operation;

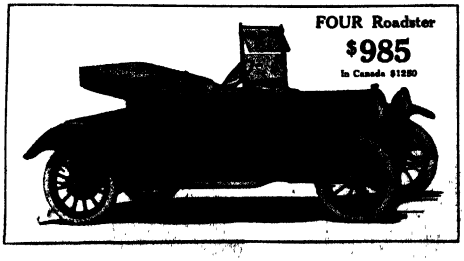
More power;

More room and added comfort.

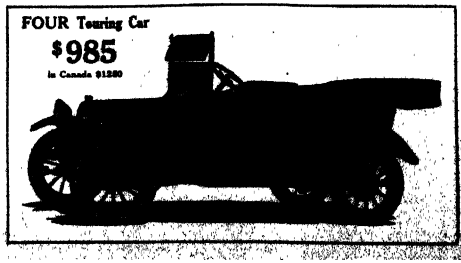
Specifications

Two Body Styles: Five-Passenger and Seven-Passenger Touring.
Wheelbase—121 inches.
Long-Stroke (5-inch), Small Bore (3½-inch) Motor; Six Cylinders, en Bloc.
Smokeless, Non-Leaking Lubrication System.
Larger Valve Openings.
New, Exhaust-Silencing Muffler.
Annular Piston Rings
Cellular Radiator.
Lighter Reciprocating Parts.
Crowned Fenders.
Lightened Clutch Operation.
150 Pounds Lighter.
15 x 2½ in. Brakes
34 x 4 in Goodrich Tires on Q D Demountable Rims; Safety Tread on Rear
Roomier Front Compartment; Roomier Rear Compartment.
Continuous Aluminum Footboard.
One-Man Type Top
Built-in Rain and Clear Vision Ventilating Windshield; Attaching Rigidly to Top.
Scientific Anti-Rumble Gasoline Tank in Cowl.
Magnetic, Non-Leaking Gasoline Gauge, the Only One Approved by Insurance Underwriters.
Full Floating Rear Axle, Shaft Locking into Taper at Hub.
Full Equipment of 13 Timken Roller Bearings.
Uniform Caps on all Four Hubs.
Irreversible Steering.
Removable Instrument Board.
Inter-Locking Ignition and Lighting Switches.
24 Finishing Operations in Painting Bodies Studebaker Blue.

FOUR Roadster
$985
In Canada $1280

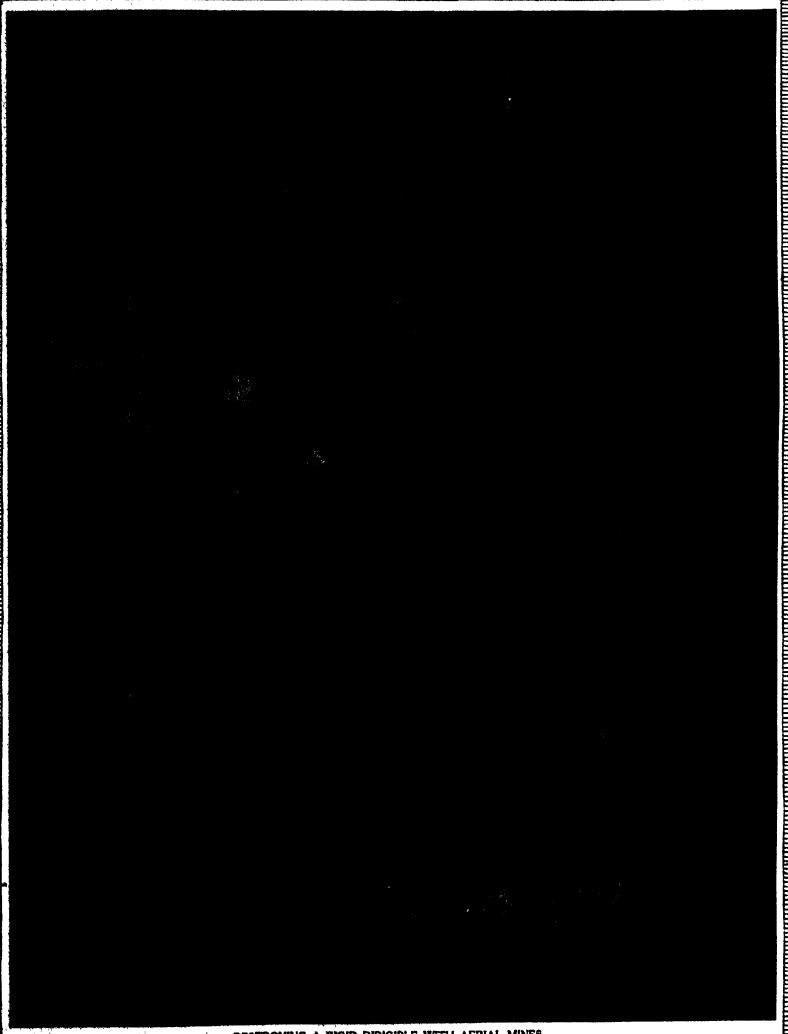


FOUR Touring Car
$985
In Canada $1280



16 NOV 1916

SCIENTIFIC AMERICAN



DESTROYING A RIGID DIRIGIBLE WITH AERIAL MINES.

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The War and Our Dilemma

IT is very difficult for the American to realize that the great European war, which has been dreaded for a generation, is actually taking place. The calamity is so appalling that it seems to stretch beyond the reach of the imagination. The desire of the President, although impotent, to avert hostilities is voiced in every American breast. It was useless to offer mediation—there was no question to mediate. There was only the gaunt figure of brute force against brute force.

After the great wave of distress for the terrible calamity which has befallen Europe has been expressed, the thought naturally turns upon what will be the effect of such an upheaval upon our own country, and what lesson can we learn from it. For years the SCIENTIFIC AMERICAN has preached the necessity of the upbuilding of our merchant marine. The story of our present poverty in merchant ships is too well known to need mention at the present time, but now, at last, the lesson is driven home in a surprising and unexpected way. Some two hundred thousand Americans are practically marooned in Europe with no facilities for reaching their country. Battleships and cruisers, even were it practicable to put our line of defense to such a use, are not adapted in any way to passenger service, and such a method of solving the problem is almost out of the question. Of navy transports, we have hardly any. The International Mercantile Marine, owned as it is largely by American capital, does not carry the Stars and Stripes, and under the terms of the purchase its larger ships may be used by the British government, whose flag it flies, under stress of war conditions. It has been said that the United Fruit Company has placed its small fleet of steamers at the disposal of the Government for the rescue of Americans stranded abroad. It is humiliating to think that the Government may be obliged to apply to private owners for the use of their vessels to aid in the present crisis. The American Line is the only transatlantic line which flies the Stars and Stripes. In recent statistics published in London, it was stated that the wealth of the United States at the present moment was almost equal to the combined wealth of Great Britain and Germany. In spite of this, owing to bad laws, lack of support on the part of the Government, and the high cost of labor, we are not able to compete with the merchant marine of other nations. We are paying enormous sums every year to foreign owners for the transportation of our imports and exports. This large sum might be kept in this country provided we had seriously entered into the field of marine competition. Experience has shown that we are capable of building as good ships of war as other nations, but we have allowed our domestic ship building to fall into decay. Now that the period of great railroad construction has been arrested, largely through the hostile legislation of the Federal and State governments, there are plenty of men with which not only to build our vessels, but to provide personnel.

It is fortunate that we have received this sinister warning at a time when we are at peace with all the world. Had we found ourselves in a serious war, the utter lack of a merchant marine, both for commerce and transports, would be a calamity for which we would dearly pay. The price now is one largely of pride and lost opportunity.

The lost opportunity will present itself a little later when our merchants are seeking an outlet for their foreign exports. Our trade with Europe has, of course, fallen into utter confusion, and will, to a great extent, be terminated. The trade between Europe and South America will be practically interrupted. We fortunately have reached a psychological moment for developing our trade with South America. Never before has there existed so cordial a relationship between the two continents. Whatever trouble may have arisen from the Mexican imbroglio, it has served one great purpose. It has brought the great republics of the South and ourselves to a better understanding, and the conferences of the A. B. C. envoys have served to show that our interests, both in humanity and in commercial development, are mutual.

It is possible for us to supply South America with most of the goods they have been importing from Europe. They are in a position to greatly increase their exportations to this country. Now is the time for our manufacturers and merchants to direct all of their energies toward cultivating trade relationship with our neighbors. They should adapt themselves to their wants and their methods of doing business; they should know their language and be prepared to correspond in the tongue of the country; their salesmen should be men of good manners and be able to converse in foreign languages. But above all we should be in a position to carry our goods in our own vessels and under our own flag. Let this government give some encouragement to the upbuilding of our mercantile marine by wise laws and we shall resume the position on the high seas which we occupied before the time of the civil war.

The present occupant of the White House is eminently qualified to carry out this work. The new tariff law and the currency bill no longer require his attention. The tension of the Mexican situation has been relaxed, the country realizes that the great need at the present time is the upbuilding of our marine. Especially is this so with the approaching opening of the Panama Canal. The recent conferences held in Washington, the object of which was to pass more liberal laws as regards the flag, indicate that the situation and the need of a better condition of affairs are at last understood there, and with a determined Executive it is to be hoped that at last the way will be opened for a new field of industrial usefulness.

The Napoleon of the Twentieth Century

CHIEF among the many dramatic features of the opening scenes of the great European war drama, is the superb daring with which the German "War Lord" has launched his mighty army against what is practically the united naval and military strength of the rest of Europe.

For the neutrality of Italy has withdrawn from the Triple Alliance a great army and a powerful navy of the most modern type. This defection leaves the Mediterranean Sea so completely in the control of the Triple Entente, that the Austrian fleet will probably never venture forth from the protection of its naval base. The Austrian army has yet to win its laurels; for, as every student of history knows, the military history of Austria has been marked more by defeat than victory. With Russia's army of triple her own strength to the north, and with the warlike Servians and a doubtful Italy to the south, Austria will be so closely concerned with her own defense, as to be able to render but limited assistance in the immediate field of operations covered by the German armies.

Upon Germany, then, will fall the stupendous task of inflicting a decisive defeat upon the combined armies of France, Russia, Great Britain, Belgium and Holland, and as seems not unlikely, of Denmark also.

And, as if this were not enough, Germany has boldly flung the gauntlet in the face of the greatest naval power the world has ever seen—a power as pre-eminent upon the Seven Seas as is her own matchless army upon the battleground of Europe.

The hope of success for Germany depends upon the quick accomplishment of two stupendous results: First, a defeat of the combined British and French fleets so overwhelming as to give to Germany the complete control of the sea; and second, the launching of the flower of her army against the French in an attack so swift in movement and so overwhelming in numbers, as to crumple up and break through the defense, and enable the German army to repeat the triumph of 1870, and march as conquerors through the boulevards of Paris! This would leave her free to strike with a like swiftness and concentration at Russia; and with the diversion produced by an Austrian advance into Russia to the eastward, she would seek to fight her way resistlessly through the Russian defense and capture St. Petersburg.

But to swiftly concentrate an army of the enormous size necessary for an overwhelming defeat of the French defense, it was necessary to violate the neutrality of a friendly nation, and, so, to the calamity of the Italian defection has been added the burden of a war with the combined forces of Great Britain, Belgium, and Holland.

It is this complication that seems to spell the ultimate overthrow of the greatest and most efficient military organization the world has ever seen. For if, as is probable, the German fleet is crushed or driven under the shelter of its coast defenses, and is thus tied up there for the rest of the war, Germany will be absolutely blockaded from the outside world. She will find its way into her dominions. She is now supporting, and Austria will be hard put to it to feed her own armies and people.

The Triple Entente, on the other hand, having command of the sea, will be able to call upon the markets of the world for supplies.

But the embroilment of Great Britain and her allies, Belgium and Holland, will have a military—a strategic—effect, that will go far to defeat the Emperor's Napoleonic dream of crushing the allies in detail by an irresistible initiative. Great Britain, with the German fleet either crushed or blockaded, will be free to land at once 250,000 men in Belgium and Holland. These troops, combined with the mobilized armies of Belgium and Holland, will constitute a total of nearly 1,000,000 men, capable of being driven like a wedge across the lines of communication of the German invasion of France. With such a diversion threatening its flank and rear, the pressure upon France would be relieved. By the time the British-Belgian-Holland flanking movement is in full swing, the Russian army corps will have moved down to confront Germany upon her eastern frontiers, and it may well happen that Germany's vigorous offensive will have to give way to a defensive fight for her very existence.

Not since wars began has so great a military people, with such a sublime confidence in its invincible prowess, played for so great a stake as that for which the German hosts are now battling on sea and land.

Should the Teuton win, he will hold all Europe in his "mailed fist," and the flag of his ships of war and commerce will float undisputed upon the Seven Seas, with nothing to stand between him and world-wide dominence but the great English-speaking republic of the New World!

Should Germany, in spite of her stupendous heroism, go down to absolute and crushing defeat on land and sea, the terms of peace may involve as a guarantee of peace by preventing the upbuilding of another such vast military organization, the break-up of the German Confederation, and Germany's magnificent naval and commercial fleets, to say nothing of her foreign colonies, will have been wiped off the face of the earth.

Had Germany shown a less ruthless spirit in flinging herself against the rest of Europe in a defiance so bold as to appear almost contemptuous, she might hope, in the event of disaster, for reasonable terms in the great final accounting. As it is, Europe, if victorious, will take a heavy toll.

Fighting in the Air

THE meager reports of actual engagements in the fateful war include the account of a Zeppelin rammed by an aeroplane said to have been a small racing monoplane piloted by the famous "looper" Garros. Garros turned up alive, thus disposing of his share in a dramatic adventure, and the feat is now attributed to a more obscure pilot. The story can hardly be credited, in view of the secrecy maintained on all sides. Such tales as this of the Zeppelin, said to have been attached to a German column crossing the frontier, are unmistakably inventions, as only aeroplanes would be employed in such a rôle.

At the recent competition at Vienna most of the French participants were "loopers" on light powerful monoplanes. One among their number carried off the prize offered for describing a figure 8 of the smallest diameter possible. During the same meet an Austrian aeroplane and dirigible were both destroyed, near Vienna, in an explosion following a collision. Garros, who was there, must have known that ramming a dirigible was like holding a burning candle to gunpowder. So the story that he deliberately sacrificed himself is given plausibility.

Against small machines artillery seems efficient only while the dirigible is running away at top speed. The utmost care in watching for them (fortunately they are very noisy), followed by clever steering, is absolutely vital. In the limitless air even a fleeing dirigible is not necessarily driven from its course. It can take to flight in a wide detour, if the racer is sighted at a sufficient distance; if it is compelled instead to turn back in its tracks, the question whether the monoplane will be hit, before it can ram, will not take long to decide. But it becomes apparent how urgently dirigibles need the support of friendly aeroplanes to harass such attackers with close range fire, cleverly putting themselves into their way without masking the dirigible's fire, and even themselves ramming, if all else should fail. To cope with the swift turns of a "looper" takes indeed another "looper," and Germany might well afford to remember that she too has her "loopers" of the first order, though they did not compete in Vienna. The value of light, quickly turning machines her military authorities were beginning to realize during the past few years. Yet even the heavy standard military machines could offer protection to a dirigible against ramming "loopers."

Electricity

Electrifying the St. Paul Railroad.—The terminal of the St. Paul Railroad at St. Paul is now being electrified, and it is expected that the work will be done by the first of next January. Work is proceeding on the main lines, and it is believed that part of it will be operated electrically by the first of the year.

Spanish Electrical Exposition.—It has recently been decided to postpone the International Exposition of Electric Industries that was to have been held in Barcelona in 1915 until 1917, when the general Spanish exposition is to be held. The combined exposition will have government recognition, and $1,800,000 will be contributed by the Spanish government toward the cost of building and other expenses. A like sum has already been contributed by the city of Barcelona.

Platinum Discovered in Germany.—Electrical engineers will be interested to learn that extensive deposits of platinum have been discovered at Wendon in Westphalia, and that they are soon to be worked on a large scale. Hitherto, we have had to depend almost entirely upon the mines in the Ural Mountains for this metal which is so indispensable in electrical apparatus. Fully 95 per cent of the world's production of platinum has come from Russia.

Electric Cooker for Chicago Baseball Team.—As it is quite a journey to the downtown restaurants, an electric range has been installed at the ball park of the Chicago American League Baseball Club. It is equipped with three top-heating units and an oven with two additional units. One of the latter may be used as a broiler. On this range hot lunches are prepared for the athletes when they are too busy to go downtown for a meal.

Miniature Motor.—Mr. I. T. Nedland, a jeweler of Hillsboro, N. D., says the *Electrical World* recently exhibited at the University of North Dakota, Grand Forks, a working electric motor weighing 34 grains, the construction of which occupied his spare time for a month. The dimensions of the motor are as follows: Length, 0.563 inch; height, 0.291 inch; width, 0.336 inch; diameter of armature, 0.071 inch; diameter of commutator, 0.0106 inch. The armature, which weighs 6 grains, has six slots and six commutator segments. A 2.5-volt battery supplies the energy for operating this tiny power unit.

Electric Fan for Horses.—Believing that horses like human beings can do a better day's work after a good night's rest, the Utah Light and Railway Company has taken steps to rid its stables of flies and to provide better ventilation. Accordingly in one stable where thirty-five or forty horses are kept, two 56-inch 4-blade ceiling fans have been installed and two 15-inch blowers. These are set in operation on warm nights in order to make the stable more comfortable. They also serve to keep the flies from pestering the horses, and, in order to keep the flies out of the stable, the windows and doors are screened. The horses are used by the company to supplement its electric truck and motorcycle service. The running expense of the electric service is less than 40 cents per month per horse and is repaid many times over in the greater efficiency of the animals.

Fire Damp Indicator.—A new fire damp indicator was recently demonstrated in London. The device is adapted to indicate the presence of fire damp in coal mines. It is based on the well-known principle of catalytic combustion resulting from placing platinum black in certain explosive gases. The device is in the shape of a torch with two differential thermo-electric couples connected in series with a sensitive galvanometer. Each thermo-couple is embedded in a bead of porous material, one of which beads is impregnated with platinum black so that in the presence of fire damp it will become heated above the other, and generate a thermo-electric current, which will deflect the galvanometer. In order to make the platinum black as sensitive as possible, each bead is heated by a resistance coil to the required temperature. As both of the beads are heated alike, there is no deflection of the galvanometer under normal conditions.

A New Powerful Search-lamp is under test at the New York Navy Yard, in which high efficiency is obtained by using a greatly concentrated arc light. Heretofore it has been found that after a certain intensity has been reached, further increase of current results chiefly in spreading the incandescence over a larger area of the electrode. In the new search-lamp, the area of the light source is even smaller than heretofore, because the electrodes are much smaller, and they are kept from rapid combustion by a cooling stream of alcohol vapor. The new electrodes are but 16 millimeters in diameter, as compared with 38 millimeters for a current of 150 amperes in previous lamps. The alcohol vapor confines the illumination to the tip of the positive electrode which hollows out into a crater filled with incandescent fumes backed with white-hot carbon. The small spot of intense brilliancy approaches more closely to the theoretical point of light which is necessary to secure a perfectly parallel beam. The strength of the beam of the new lamp is about six times as great as that of the old. The alcohol vapor is generated by an electric heater. To obtain a uniform burning of the electrodes the rods are rotated.

Science

Rio Theodore.—This name has been given by the Brazilian government, at the suggestion of Dr. Müller, Brazilian Secretary of State for Foreign Affairs, to the river recently explored by the Roosevelt-Rondon expedition, and heretofore known as the Rio da Duvida. Col. Rondon's report on the expedition gives the geographical co-ordinates of a number of points along the river, making it possible to place the river in approximately its correct position on the map. These are quoted in the July number of *Petermanns Mitteilungen*, and show the course of the river to be almost due north and south.

The South American Expedition of the University of Pennsylvania Museum has completed a year of highly successful exploration in the region lying along the boundary between Brazil and the Guianas. Besides important geographical discoveries, the expedition has obtained ethnological information relative to twelve different tribes, half of which were hitherto entirely unknown, including vocabularies and other linguistic studies, anthropometric measurements, collections of myths and legends, and about 600 photographs. The next work of the expedition will probably be in the territory drained by the upper Rio Negro and the upper Orinoco.

The British Association in Australia.—About 400 members of the British Association left England early in July, and were due to reach Perth, Western Australia, August 7th, from which point they were to proceed to Adelaide. Here the retiring president, Sir Oliver Lodge, was to deliver a valedictory address. After four days in Adelaide the party was to proceed to Melbourne and Sydney, at which places the greater part of the addresses, papers and discussions would be heard. President Bateson's presidential address was to be divided into two parts, delivered at Melbourne and Sydney, respectively. Many excursions will follow the meeting. One party will travel across north Queensland, while others will visit New Guinea, where the commonwealth government has placed a yacht at the disposal of a specific anthropological investigation.

Spectacles for Artificial Light.—Mr. H. E. Ives, an English physicist, who has been for some time investigating the production of light giving a daylight spectrum, has recently suggested the use of colored glass spectacles for viewing objects illuminated by artificial light when it is desired to see such objects exactly as they would appear in daylight. The glass would be covered with a collodion or gelatine surface, stained with aniline dyes carefully selected to filter out the light rays peculiar to artificial light. For each kind of the latter a special formula would have to be followed in preparing the spectacles. These spectacles would be useful in many industries, as, for example, the making of artificial teeth, where color has to be most accurately matched. They might also be lent to visitors at picture galleries, by night or on dark days, when artificial illumination is employed, in order to insure the most favorable view of the pictures. Many other uses will no doubt suggest themselves.

Densities of Minerals and Rocks at High Temperatures.—A new method for determining the densities of minerals and rocks at high temperatures is described by A. L. Day, R. B. Sosman and J. C. Hostetter in the *American Journal of Science*. The substance is held down by weights under an inverted crucible of graphite, which is immersed in a bath of molten tin or silver. Tin has the conveniently low melting point of 232 degrees. The measurements are made by noting the weight required to pull down the crucible and the assay to a given depth marked on a stem connected with the crucible. The graphite is protected from oxidation by an atmosphere of nitrogen and carbon monoxide. The density curve of the metal used and the expansion coefficient of graphite are, of course, factors in the calculation of the results. One of the most interesting of these is that as the temperature (575 degrees) at which α-quartz passes into β-quartz is approached, a striking increase occurs in the rate of expansion.

Exploration and Exploitation of Angola.—This large Portuguese possession, one of the least known portions of Africa, has recently been the theater of explorations on a very extensive scale by a French expedition under Count Jacques de Rohan-Chabot. During the years 1912–1914 a total distance of about 4,350 miles was covered by the explorers, in the southern part of the colony, between the Atlantic and the Zambesi. Numerous positions were determined astronomically; magnetic and meteorological observations were made; and an ethnographic survey was carried out. The country was found to be very sparsely inhabited; in fact, there are vast territories without any inhabitants. The climate is unhealthful, and mosquitoes are a terrible pest. Nevertheless, the exploitation of this region is now greatly interesting German capital. Several missions of investigation have been sent thither from the adjoining German colony of Southwest Africa, and plans are on foot for developing a railway system, to be connected with the German lines to the southward.

Aeronautics

A Lighting and Starting Improvement.—Patent No. 1,103,195, to William R. Gordon, of Kinloch, Mo., presents an air-craft of aerohydroplane type having a convenient arrangement of boat body and planes with a special view to equilibrium and alighting and starting in uneven fields.

Shooting a Parachute into Operative Position.—In a patent, No. 1,103,233, for safety appliance for air-craft, Edward L. Waight, of San Francisco, Cal., combines with a parachute case on an airship, explosive means for discharging the parachute from the case into operative position and automatically producing the explosion at the required instant.

Another Gyroscopic Balancing Device for Aeroplanes.—William R. Jones, of Summitville, Ind., has secured a patent, No. 1,102,515, in which is provided a gyro-pendulum which may be attached to aeroplanes, and is adapted for connection with the steering device to steer the aeroplane independently of the operator; also provides means for automatically balancing and steering the aeroplane either horizontally, up or down, or spirally, according to the preliminary action of the operator.

Fins on French Machines.—The question of spiral stability is receiving some attention from French designers. Our Paris aeronautic correspondent, Mr John Jay Ide, tells us that the new army Morane-Saulnier are all fitted with a vertical fin forward of the rudder. No doubt a fin was found desirable on the Moranes on account of the fairly great amount of side area forward. R Esnault-Pelterie was one of the first designers who realized that tail fins were desirable. His 1909 machines were fitted with them.

The World's Aeronautic Laboratories.—There are already six great aerodynamical laboratories scattered throughout the world The oldest of these is that directed by Dr. Riabouchinsky, at Koutchino, in Russia, next comes that of M. Eiffel, in Paris, a private institution where this famous engineer has carried out research work of inestimable value for years past. Paris possesses another laboratory, planned on an ambitious scale, founded at St Cyr through the generosity of M Deutsch and controlled by the University of Paris. At Rome there exists a well-equipped laboratory belonging to the Italian Aviation Corps, and finally there is the admirable aeronautical section of the National Physical Laboratory at Teddington.

A Combined Bomb and Arrow.—M. Guerre, the inventor of an explosive projectile for destroying aircraft in the shape of a combined bomb and arrow, made some interesting trials of it from the Solferino Bridge in Paris. The projectile consists of a small and very light bomb with a very sensitive detonator which can be set just before throwing. In the rear of the shell or head is a guiding piece with "feathers," resembling a short arrow. Several of the projectiles were thrown from the bridge down on a bed of sand on the quay, and they took fire at once, exploding at the same time Such a bomb would no doubt do great damage to an airship, and it is well adapted for use in an attack of aeroplanes upon airships, for instance.

Shortening the World Flight.—Commander J. Foster Stackhouse, of the British Antarctic oceanographical expedition, has pointed out a possible saving of 400 miles in the Greenland-Iceland leg of the round-the-world flight to Arnold Kruckman, the Panama aeronautical commissioner. The original route called for a 600-mile flight over the open sea from Greenland to Iceland, but Commander Stackhouse advises that the flight be made across Iceland instead of around the coast, because of the prevalence of fogs off the coast. He also pointed out that the extinct ice-capped volcano of Iceland was visible for 100 miles and would serve as a guide to the aviators when only a short time out of sight of Greenland, and owing to the numerous fishing vessels in those waters, the aviators would not be out of sight for more than half an hour at a stretch.

New Aeroplane Wing Sections.—Among the principal tests carried out in the National Physical Laboratory are the determination of the lift and drag of various wing sections, the distribution of pressure on planes, the resistance of variously shaped bodies —such as airship hulls or aeroplane struts—and the various aspects of stability. These experiments have led to the evolution of a highly efficient wing section, which has been incorporated in the latest military aeroplanes. The ratio of its lift to drift is close upon 14½ to 1; the under surface is almost flat, only the upper surface being curved or cambered, thus showing that, contrary to the general belief a few years ago, the upper surface of a wing plays an important part in producing lift. The deepest part of the curve is situated rather farther behind the entering edge than usual, being at a distance of approximately three eighths of the chord from the leading edge. By this means it has been found possible to avoid the sudden drop in the lift which, for some reason which still awaits explanation, occurs in the case of other types of wings when these attain an angle of about 16 degrees, and thus constitutes a serious source of danger.

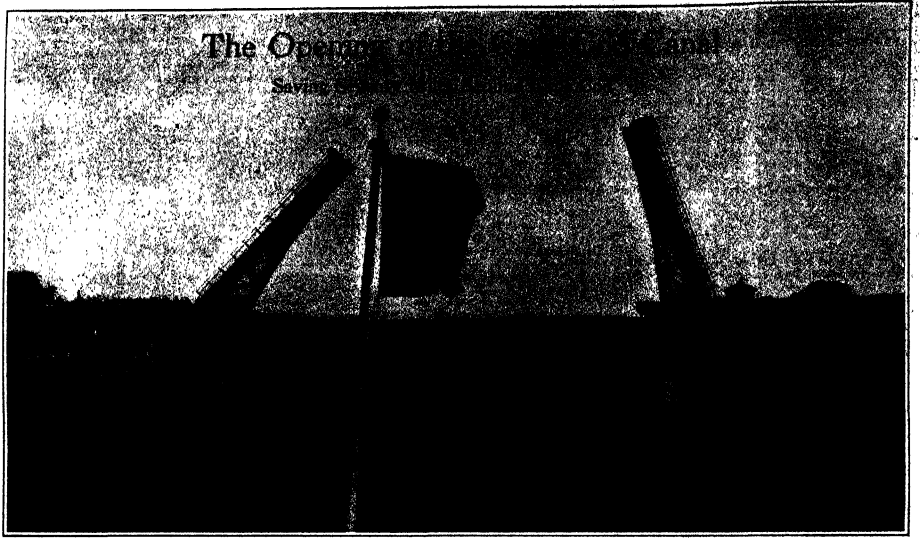
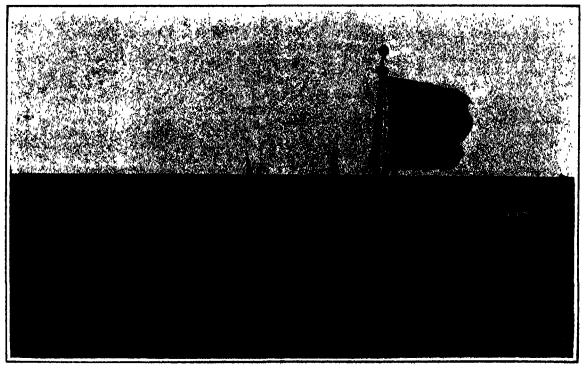


Photo by Lovick.

The Sagamore bridge near Cape Cod Bay.

WITH the opening of the Cape Cod Canal, which took place on July 29th, one of the most important waterways in this country has become available for coastal navigation, but because of comparatively moderate size, and the absence of any spectacular engineering feats in its construction, so little attention has been given to the project in published descriptions that few people have any definite information in regard to the new canal, and a brief review of the principal facts relating to it seems appropriate at this time.

The canal proper is eight miles long, and is excavated across the narrow neck at the base of Cape Cod, on the Massachusetts coast, and connects the waters of Buzzards Bay on the south with those of Cape Cod Bay on the north, thus shortening the distance between Vineyard Sound and Boston by about seventy miles, and enabling vessels to avoid a considerable stretch of exposed and stormy water that is made especially difficult for navigation by numerous reefs and banks, together with strong currents, and also by the prevalence of fogs, and as a large portion of the traffic in these waters is by sailing vessels and towing barges, these factors have caused serious and regular delays not to speak of many losses of vessels by shipwreck. Besides joining up the waters mentioned the canal has a wider significance as being an important addition to the series of protected waterways which are being perfected along a great portion of the Atlantic coast, and which will greatly promote and facilitate extended coastwise navigation by small vessels.



Eastern entrance to Cape Cod Canal.

There are no locks in the canal, as it has been built at sea level, although there is an actual difference of a few feet in water level between the two ends, but this difference creates no difficulties, and the slight current is regarded as an advantage, for it is not sufficiently great to affect vessels passing through. It is expected that it will greatly assist in preventing the formation of ice during the winter months.

There are no kinks or corners in the channel, and although there is a trifling curve, the radius of this is 7,640 feet, which makes the curvature so slight as to be almost unnoticeable; and as the entire canal is to be brightly lighted by electricity at night, there will not be the slightest difficulty in making the passage at any time either night or day. The only obstructions that will be met are a few railway and highway bridges, but as these are all modern, rapid-acting structures, having a width of 150 feet in the clear between piers, they should cause no practical delay.

Through most of its length the canal is about 100 feet wide on the bottom, and the depth is 25 feet at mean low water, but at three points in the passage the bottom width is increased to 250 feet to form passing points for vessels, and in the approaches to the canal a width at the bottom of from 250 to 300 feet is maintained. These approaches extend the 25-foot channel to deep water at both ends of the canal, and have a combined length of about five miles; and on the Cape Cod Bay side a massive breakwater has been carried out 3,000 feet from the shore line to protect the entrance of the canal from the filling-in action of the waves and to form a shelter harbor for shipping using the canal.

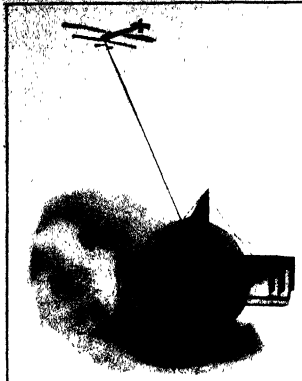
In excavating the canal most of the work was done by hydraulic dredges, as most of the material to be removed was of a sandy character. In this work two immense suckers capable of handling 4,000 cubic yards per day were employed. In one place a considerable deposit of bowlders was encountered, many of which were of large size, and it may be said that the removal of these, which was accomplished by large steam shovels, constituted the most difficult part of the undertaking. The total amount of material excavated is said to have been in the neighborhood of 20,000,000 cubic yards. At present the canal is open for vessels not exceeding 15 feet draught, but it is expected that a depth of 25 feet will be secured in the near future, and the plans look for an ultimate depth of 34 feet.

Although the Cape Cod passage was designed and constructed wholly as a commercial enterprise, already the European conflict has called attention to its special value in time of war. While for some time Massachusetts Bay and the New England coast have been considered weak points that would be difficult to provide for in any system of naval defense, the new canal has materially improved the situation. It will not accommodate our big warships, but it will soon be able to float vessels large enough and powerful enough to make a blockade of Eastern waters impossible for foreign ships.

The foregoing emphasizes the fact that this canal is wholly the result of individual enterprise. While large sums of public money have been annually squandered on "pork barrel" principles on obscure inland ditches whose use was entirely problematic, it has never been possible to interest the Government in an enterprise that possessed the unusual merits of public value evident in this new waterway.

Inconspicuous as this undertaking has been, it is undoubtedly one of the most important waterways completed in this country for many years, as the immense water traffic with New England, amounting to 25,000,000 tons per annum, has hitherto been obliged to make the long and dangerous detour around Cape Cod, resulting in long and constant delays and heavy losses to navigation which have constituted a severe tax on both

(Concluded on page 138.)



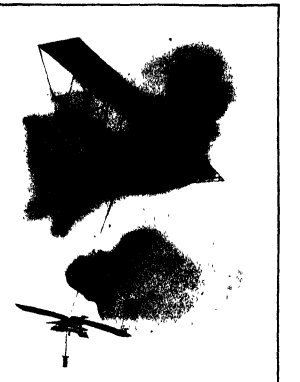
An attack from the rear.

The Air Bomb

A New Method of Mining the Air and of Thwarting an Attack by Flying Machine or Dirigible

The Inventor's Explanation and a Critic's Objection

By Joseph A. Steinmetz and Carl Dienstbach



A contest of speed.

Aerial Offense and Defense

By Joseph A. Steinmetz

AERIAL warfare, like fighting on land or sea, resolves itself into offense and defense.

The defense of land areas, for example the very vulnerable works of the Panama Canal, against attack and destruction by aircraft, can be successfully accomplished, as explained so fully by Mr. Dienstbach, by the use of aerial mines. This same scheme of defense would apply as well to the battleship fleet afloat, the units being so spaced that the balloons could not interfere or entangle when blown about in turbulent air.

The offensive action, or attack to destroy, involves problems new and more difficult, and here Mr. Dienstbach very ably sums up some of the possible troubles in a theoretical action. The attack, for example, against a Zeppelin would be delivered by several swift aeroplanes directly as the arrow speeds to the mark. It is not contemplated to maneuver an aeroplane with the pendent bomb hanging free. At the moment before passing over the object to be destroyed, the bomb is reeled out by gravity, and the speeding machine is across and beyond before the feed reel is checked. Using the enemy as the resistance body over which the wire is pulled permits of a run out of a thousand feet or more before the fatal charge is exploded into the gas bag. Such an attack at night or in uncertain weather, foggy or windy, would be irresistible, and the opposing artillery would be at a serious disadvantage.

In a black night the destroying aeroplane would fish for the noise of the enemy in the void below, and no matter what the swing of its deadly tail, could soon hook and destroy the leviathan of the air.

The aeroplane artillery units thus far devised have not been mounted to repel attack from the rear, but rather in view of forward action.

In no sense does the Steinmetz aerial offensive device usurp the place of the artillery, but supplements it. This fact would be developed in an engagement between two aeroplanes mounting guns, such as the bow mounts of the Voisin, Benet-Mercier, Farman, Deperdussin, and other French aircraft. The attack would involve a swift approach, and as was suggested in a recent newspaper review accredited to Lieut. Bellinger operating our O. W. L. planes with our fleet at Vera Cruz, "one aeroplane could ram and destroy the other." This is too expensive and wasteful a process of elimination. The recent dreadful tragedy in Austria, when an aeroplane slit open and ignited a dirigible, was an example of ramming. Therefore, with artillery equipped aeroplanes in action and coming together at a mile-a-minute speed, the result must be either a successful disabling shot, a head-on crash, a quick bank, or a vault over.

The plane equipped with the Steinmetz bomb unit would rise over the enemy, disconcerting his range, and, letting slip at the instant of incidence the death-dealing tail, would finish the affair.

The weight of artillery units with ammunition runs into hundreds of pounds, whereas the trailing bomb and wire reel equipment complete weighs but 25 pounds, and can be used with light weight aeroplanes by inexperienced civilian operators.

In time of war the units could be issued from stock in unlimited quantities and attached in an instant, without the delay and heavy expense of creating and mounting untried guns, more or less of experimental models. Indeed, it will always be a serious matter to find and train sufficient aerial artillerists, and this shortage will be always in proportion to the growing need of gunners for the land and sea batteries.

There is another phase of the pendent bomb destructive units not touched upon by Mr. Dienstbach; the attack at ground level in destroying the hangars and dirigibles at rest, igniting the gasoline and commissariat supplies, derailing troop trains, and crippling transports.

On water the attack could demoralize landing parties, smash the wireless of battleships, blow off the periscopes of submarines, and perform similar service, impossible at night by aeroplane artillery.

A quick mobilization for war of the air forces would include civilian aviators flying private craft and unfamiliar with artillery science.

In Germany owners of large motor trucks are subsidized as army transport units to serve in time of war. In some such manner must privately owned aircraft be counted as part of the aerial defense of nations.

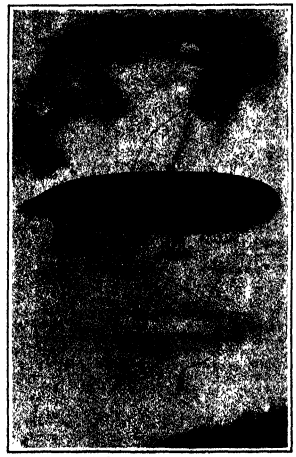
Such an air force must be available at almost instant notice and must be lightly equipped and mobile, able to defend itself as well as to destroy.

The civilian aviators and raw recruits will not be skilled artillerists, but must, wasp-like, be able to strike and sting with pendent bomb delivering out of the blackness of the night down to the enemy their *coup-de-grâce*.

A Criticism of the Steinmetz System of Aerial Offense and Defense

By Carl Dienstbach

SO close are the analogies between warfare at sea and in the air, it was no more than natural to propose the adaptation of mine and torpedo, which play such a highly important part in naval war, to aerial conditions. The thought has been amplified and perfected in an interesting device recently patented by an American, Mr. Joseph A. Steinmetz. This device has the advantage of great simplicity and cheapness. As its inventor was well aware that the largest aerial dreadnought may be destroyed by the smallest amount of explosive, he hit on the idea of merely combining three well-known elements. He suspends a hand-grenade from a small "pilot" balloon held to the ground by a long piano wire. When the wind is high he proposes the substitution of a device entirely identical with the meteorological box kite in daily use at aerological observatories for lifting meteorographs to great heights. The hand-grenade, somewhat differently suspended, takes the place of the meteorograph. Inasmuch as the Lindenberg observatory in Germany publishes daily every change in the location of its kite wires and employs beacons at night as a warning to aeronauts, the use of the Steinmetz device is obvious, all the more as it may be readily manufactured and distributed in immense quantities, and, once established, be operated by an army of unskilled feeble non-combatants. The small balloons may be sheltered on the ground in any stable or shed and be sent up or hauled in at will by any sort of reel or windlass. The one rather complex accessory required would be a gas-carrying automobile, such as is used for the replenishing of the diminished gas supply of German dirigibles in inaccessible places; for daily rounds of the whole mine field must be made to refresh the balloons by a few cubic feet of pure gas from steel bottles.



Attacking with pendent bomb.

The experience of meteorologists, however, tends to show that the handling of kites is by no means simple or easy, and that the wholesale use of the device which constitutes its chief value will, therefore, be likely restricted to calm weather. This suggests at once another indispensable accessory—a signaling system to the multitude of unskilled operators for instantly passing the command to "haul in." Such an important decision may obviously not be left to their individual discretion.

A curious and entirely novel use seems to suggest itself here for wireless telegraphy. Optical signals are not dependable, acoustic ones too audible, and signaling by wire is too expensive. But wireless is excellent for distributing intelligence. Its very essence is distribution, and it seems high time that this peculiarity, which for regular commercial telegraphing represents rather a necessary evil, should for the first time be turned to advantage in war. As the distances to be bridged from a central station are comparatively small, the reliability is irreproachable, and the simplest apparatus suffices. The receiver reduces itself to a "magic pillbox" before the eyes of the unskilled operator, with a little dial on which one single change indicates the instant for hauling in. Wireless, now so commonplace in its usual employment, becomes again such a marvel in this novel rôle, that one wonders why its hidden possibilities are not more thoroughly exploited.

The value of the Steinmetz device is not diminished as much as it may seem by restricting its use to calm air, for the simple reason that the enemy's dreadnought dirigibles will obviously operate at night, and will pick out the calmest of the generally calm nights for finding their objects of attack and casting their bombs with something like accuracy. The moral effect of expecting to run into a mine at any nook and corner will more

than repay the outlay; especially, if it will restrain aircraft from operating in weather in which they are most to be feared.

As the value of the Steinmetz device lies entirely in quantity, a warning against its use in turbulent air seems justified. Observation officers in the baskets of military captive balloons in any wind are often hauled down seasick after having been blown about. It would not take a storm long to transform an aerial mine field into a hopeless tangle of live bombs which would presently come down on the heads of those that were to be protected.

The aerial mine is inferior to the sea-mine not only in its vulnerability to currents, but also in its visibility. Furthermore, it cannot (*at first sight*) be more dangerous to aircraft than a sea mine would be to submarines, which, unlike ships, are likewise not restricted to one level of flotation. Against all these handicaps the aircraft can oppose only its cheapness and lightness. The former quality allows its use in countless quantities, the latter covers not only one but many levels of flotation, as an aircraft striking a wire will most probably strike the mine as well, just because the wire will instantly cut into the soft outer material of the structure, and unless it tears, provide for itself a guide from which it cannot slip until it has hauled the mine at its end against the moving craft.

Visibility is a more serious drawback, as the first balloon sighted would be undoubtedly the signal for a Zeppelin to rise to its top level of flight, but that in itself would be protection to those below. But as efficient aiming requires comparatively moderate altitudes, the Zeppelin might not wish to rise higher than necessary above the level of that first balloon. It is at once seen how important it is to anchor these balloons at a variety of levels, all, of course, as high as practicable, by allotting the lengths of wire according to the skill or clumsiness of the operators. Discovering the balloons at night would be at best like guiding a steamer at night among icebergs. Compared to the pace of a modern Zeppelin, the "Titanic's" fatal speed was insignificant. It is seen at once how useful airmines will be in reducing the speed of attacking aircraft, in making it possible to spot them with searchlights and shoot at them.

Mr. Steinmetz also proposes to turn his mine into a torpedo, or means of offense, by omitting the small balloon and suspending the bomb by a long wire from a dirigible or an aeroplane. He thus intends to "hook" other aircraft with an explosive grappling device, by dragging the wire from above across the bulk of a dirigible or an aeroplane. The plan has the merit of simplicity; without previous alteration any aeroplane or dirigible may thus be equipped for attacking.

But its efficiency is far more problematical than the mining scheme. Unless the attacking craft follows a rigidly straight course for miles without change of speed, the bomb at the end of the long wire is bound to oscillate through an immense arc. Even so, the wind should rock the light bomb easily. If the attack requires lively maneuvering—as it naturally should with the enemy trying to dodge—the course of the bomb will be very erratic, and the wire's direction become so irregularly different from that of the attacking craft that the enemy's being hit will be as much a matter of accident as with a stationary mine. If it were possible to set a whole mine field moving; in other words, fly a whole flock of aeroplanes in close order, each dragging its bomb: the plan would evidently be even more efficient than stationary mines. But it would, obviously, quickly result in a general disastrous entanglement. A few widely scattered bomb dragging aircraft would, on the other hand, be worse than a few widely scattered mines. They would be more conspicuous and, moreover, at any possible range of their erratic weapons the point-blank high-angle fire of the enemy would be of deadly accuracy. Generally speaking, as meritorious as the modified mining idea may prove in the air under certain circumstances, as misplaced seems the idea of aerial torpedo attack. For this there is no object, because, unlike at sea, in the air a shell hit is just as deadly as a torpedo hit.

Suspending Life

By the Paris Correspondent of the Scientific American

IT appears from Dr. Becquerel's remarkable researches that life can actually be suspended for periods of time which can last almost indefinitely, then the organism, which appeared quite dead before, is seen to come back to life and resume its usual functions. The importance of the following experiments made upon the lower orders of life can hardly be overestimated, for the results are of such a nature as to establish to all appearance that life is not a continuous phenomenon, but can be actually stopped, then to recommence again. The following was written for the leading Paris newspaper, *Le Matin*, by Dr. Becquerel, who has a prominent position in the botanical department of the University.

It may be asked whether it is possible to suspend the vital functions of a living being and thus free him from the action of time for an undetermined period, then bring the subject back to life again. Such is the far-reaching problem which biologists have before them in connection with the phenomenon of "latent life," that singular faculty possessed by microbes, spores, eggs of certain crustaceous animals, seeds of plants, and even completely developed animals such as rotifers and other lower orders. In all cases they appear to undergo a natural mummification from the fact of drying up, and can wait several years or even much longer, then coming back to life under favorable conditions for their evolution. However, in nature it is quite difficult to ascertain whether such germs have their life only slowed up or really stopped, for their drying is not complete and their protoplasmic substances always contain a certain amount of water or gases which serve to keep up their physiological functions, even though in a very feeble state. But in the laboratory the result is not the same, for we now possess more powerful means, and by using almost perfect vacua, very strong agents for removing the water, and sources of heat, it becomes possible to keep the germs alive and at the same time remove all water and gas from their cells. Prof. Maquenne demonstrated this in the case of wheat grains, castor bean and others, and the author did the same with pea and buckwheat. It was thought that *perfect suspension of life had been thus realized*, but others maintained that such was impossible, and were it so, that death must ensue. The vital functions were not actually stopped, but only very much slowed up, for there may be a very slight difference between an almost and an entire suspension of life which is enough for the purpose. Dr. Becquerel then undertook to answer this objection by the use of the extreme cold afforded by liquid air and hydrogen. The striking experiments made by Pictet, Dyer, Fadyen, and Dewar showed that germs could resist such intense cold, but the germs still contained water and gas and were not placed in a vacuum. To make the result conclusive, the three conditions for suspension of life must be united, that is, greatest amount of dryness, highest vacuum, and greatest cold. The author was fortunately able to *realize all this at Leyden by the aid of the eminent* scientist Kammerlingh Onnes, who placed the resources of his laboratory at his disposal. Thus the specimens could be kept for three weeks at the temperature of liquid air (— 190 deg. Cent.) and then for seventy-seven hours at the extreme cold produced by liquid hydrogen (— 250 deg. Cent.), using grains of wheat, mustard, spores of aspergillus and others, and various bacteria, all of which were kept in sealed glass tubes having the greatest possible degree of vacuum. The three conditions of cold, dryness, and vacuum were now realized to a remarkable degree. It is gratifying to state that the experiment was a complete success. All the grains at the end of one year and the spores after two years in vacuum, once planted or otherwise allowed to grow, were seen to germinate quite as usual. It is to be noticed that in this very special case the cells were deprived of water and gas, and the protoplasm became hard as stone and lost its state of colloidal solution, at least while it was under the combined action of cold, dryness, and vacuum. It can no longer be objected that the life is only much slowed up, for it is well known that life without water, gas, and chemical reactions is impossible. Dr. Becquerel thus maintains that the experimental suspension of life, all the while with the possibility of coming back, and this for a time which appears to have no limit, is perfectly realizable.

Such a result brings about physiological consequences which are most interesting. In the first place, it refutes the great principle of the continuity of vital phenomena, by which it was affirmed that life is a succession of uninterrupted phenomena which could not have the least stopping without causing death. The axiom "life comes from life" now receives a setback, for in the present case life is actually stopped, then it commences again. Before the present phenomena it will be impossible to maintain the "vitalist" doctrines which certain scientists and philosophers still uphold. Life is not, as they think, a mysterious force or a directive power which comes from a world in which physics and chemistry have no part and which for that reason escapes the inflexible determinism of natural phenomena. Continuing the ideas of Claude Bernard, the author takes the ground that life is no more than the exceedingly complex physico-chemical working of protoplasmic organisms, which are determined by their incessant relations, their continual exchanges with elements of matter and different forms of energy.

Not less disconcerting and of wonderful scope, are the biological consequences of the suspension of life. By using such methods in the laboratory, it will be, perhaps, possible to preserve specimens for as many centuries as seed be, using, for instance, germs of certain vegetable species and to hand them down to our successors as check specimens or points of comparison in order to determine the amount of variation of such species, comparing the new with the old. Another remarkable conclusion enters in, that when the vital energy fails—and that will happen sooner or later—in some hundred thousand centuries—when all the living beings perish, their germs may be preserved in a latent state of life for a very long period after that. In fact, the three conditions of vacuum, dryness, and cold would then be realized. It is a question what would become of all the germs which are preserved on our planet when it takes the conditions of the moon, for instance. Were the earth to come under the influence of a new sun, it may be asked whether the new radiations would awaken the germs to life, and thus commence a new animal and vegetable reign. Or if not, the planet might break into fragments from shock or explosion and the meteoric fragments charged with the germs, as Lord Kelvin thought, would go to re-people new worlds. Probably not, the author thinks, for chemical and microscopic examination of meteorites does not bear out that idea.

Plants and Disease

SO closely is the idea of suffering associated in our minds with that of disease, that it appears at first sight a mere figure of speech to refer to certain disorders in plant life as "diseases." A very little reflection, however, shows that the term is fully justified, and that pain, while a very frequent concomitant of disease in animals, is not its chief characteristic. In fact, such pain may be regarded as a danger signal, warning the organism to take *action* against an enemy. And just because the higher plants do not *actively* oppose enemies (since they have, in the majority of cases, no mobile organs) there has been no occasion for a sense of pain to be developed in plants.

How, then, do plants react against injury? How do they resist such attacks?

It may shed some light upon this question if we briefly consider the corresponding inquiry: How do animals react against injury? In this case we find that there are two distinct methods employed. An illustration will best explain this point.

If the enemy is sufficiently large to be discernible by the senses, the organism reacts either by seeking protection in flight or under cover, or by warding off the enemy by direct counter attack. But with invisible foes—microbes—this method fails; the organism then has recourse to physiological and chemical weapons of defense. The phagocyte or amœboid cells of the blood do their best to devour the invading hosts of microbes. At the same time antitoxins may be manufactured in the body to counteract the toxins or poisons produced by the bacteria. Now a plant is to all intents and purposes blind, deaf, and devoid of all our finer senses. It must, therefore, react against many enemies plainly visible to us, just as we react toward the invisible microscopic hosts. The fly alighting on cattle in the pasture is promptly whisked off by a member specially provided for this purpose. But an insect alighting on a plant is free to make such attack as its nature prompts, for the plant in all but a few exceptional cases of insectivorous species, neither sees nor feels the enemy, nor, even if it did so, would it be able to ward it off by action.

It is, therefore, only reasonable to expect that plants may in a large measure use chemical means to ward off not only microscopic, but also larger enemies. We should naturally expect that plants, devoid as they are of active means of defense, should have developed to a rather higher degree than is the case in animals, various passive means of defense. Among such there readily occur to our minds thorns and prickles, which indeed are extremely common protective devices in plants. But is it not very probable that plant juices also may serve to keep off insects and other enemies? If so, we should expect that any degree of malnutrition, any deficiency in soil, any excess of moisture or other untoward circumstance, should immediately expose the plant to the danger of invasion by insects and other pests. *And vice versa*, we should argue that the most rational method of fighting such invasion would be, not so much to attempt the often extremely difficult task of exterminating the *preying species*, but rather to strengthen the plant so as to enable it to manufacture those juices by means of which it wards off enemies.

Plausible as these conjectures appear, it must be admitted that facts are not wholly in harmony with them. For while in some cases plants are very strikingly more susceptible to insects when the plants are weakened, authorities tell us that in most cases the insects seem to find vigorous plants just as susceptible as the weak ones. With fungous and bacterial diseases the greater susceptibility of weak plants is more general, although not universal. The cases in which plants are suffering from malnutrition, abnormal soil conditions, excessive moisture, or other unfavorable circumstances, are very large, however, and such plants are found more susceptible to these diseases.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Science and Baseball Pitching

To the Editor of the SCIENTIFIC AMERICAN:

A thing greatly to be desired is a testing place for baseball curves. I suppose the best place would be on the premises of one of the league grounds; handy for leading pitchers in turn from all parts of the country, as well as for local men; but conducted by residents, e. g., a few men in turn appointed by the scientific or athletic department, or both, of some nearby college or association. The apparatus would be cheap—a few small screens for right and left curves. Up and down deviations, if gone into, would require something more. Here could be carried on for a considerable length of time (as desirable) an accumulating, confirming series of tests; e. g., as to how often, relatively, balls curve out of the plane of the parabola; if it is caused only by twirling the ball; if it can be done at will; or how frequently; by what pitchers or class of pitchers; which revolutions, right or left, produce which curves, etc. The accumulated and reliable data would be of great practical use to pitchers (as we shall notice further) and to science. Better find out just what really happens, and how much, before trying to explain how or why it happens.

There seems to be an almost universal belief in the wide use of in and out, up and down "shoots," "fade-aways," "floating corkscrews," etc. The scientific mind naturally asks (1) why this large belief in this large performance; (2) what cause there may be for some curvature. These are not necessarily the same question. There was some advantage in the old-fashioned college curriculum, including, e. g., something of both psychology and physics. In all the published discussions that I have seen it seems to be taken for a settled fact that all this throwing of wide curves is going on all over the country, and that it is up to the material scientists alone to explain it all. Psychology suggests, e. g., how much of what most people believe is from hearsay. How many out of tens of thousands get squarely in front of pitched balls and try to see if there are lateral curves? In a case like this the opinion of the great majority is utterly worthless. Next, of those who have carefully tried to see, how many know the absolute requirements; that you must get the catcher out of the way and have your eye exactly in the plane of the parabola to see whether the ball goes out of that plane. And how is any human being going to know just where that invisible plane is going to be? So much for those who simply say, "I have seen it." As an approximate test of appearance, I stretched a fine wire about sixty feet long. On it I hung a baseball by a sliding ring. To the ring I attached a small fish line, and arranged weight and pulleys so that when released the line would draw the ball swiftly to the other end of the wire. If I placed my eye at the wire, of course the ball would seem to come straight all the way. But if I was a little away from the wire, the ball would seem to come straight toward me at first (so sharp the angle of deviation) and then to swerve off quickly toward the last. This, I repeat, was only a test in appearance. The curve of the falling ball would complicate it more. Optical illusion is more common than many imagine. Everybody used to believe the sun rose and set, because they "saw it." They killed Bruno for denying it. Some insult people now for doubting what they "saw." Animal painters always thought that horses ran in a certain way till the kinetoscope proved them entirely mistaken. In moving pictures (founded on optical illusion) there is a special illustration of curves, viz.: If there is represented something coming from a distance toward the spectator, say a railway train, it will seem to come straight toward you, or almost so, and just as it passes, to curve or swerve off to the side in a most astonishing way. But we know there could be no such curve in the railway track. Suppose your eye is half a foot off the parabola. The ball in coming ten feet deviates only about an inch from your plane, so sharp is the angle, and in half a second it whisks by you half a foot to the right or left. Of course, it seems to curve, especially at the end of the flight. So much as to the "they say" and the "I saw" and the psychology. What influences more educated and even skeptical minds is that writers in leading magazines refer to those curves as settled by experiment. From these and from articles that I could obtain on the subject, about all that I could learn was that a long time ago the experiment was tried with "two posts," that about forty years ago [illegible] at Yale; thirty years ago a prominent [illegible] in the eleventh amongst, pitched a ball that [illegible] the west side of a 2-inch stake, on the east side of a 6-inch fruit tree, and on the west side of an [illegible] inch; and one, I think, with better appa-

ratus, somewhere in Ohio. These experiments should not be denied or underrated. They aimed to see that a certain thing could be done. But they are not scientific proof of all the curve pitching that the masses talk about. I would say, by the way, that less than three posts can prove nothing, and posts, trees, and sticks leave some room for doubt. I used three screens. I may add that I did not succeed in pitching any curves. However, I had to move away soon. I left the screens on the grounds, but never heard of anyone succeeding, although there were some wonderful "curve pitchers" about. With all the talk and print about curve pitching all over the country by amateurs as well as professionals (the wonderful shoots, jumps, etc.), one would think what a skillful science and practice it must be by the great league pitchers. (Of course those men are not responsible for what is said about them.) But what do we find? Mr. Irwin said the great professional pitchers he consulted did not pretend to know the theory of curves. One thought of trying to see if he could pitch curves purposely as he wished. This is the great age of science, and baseball is an obsession of this country, and still all this curving is asserted and denied.

As to explanations, so far: We know that a sudden gust of wind coming at the eleventh or other time will deviate a ball some. But that is not frequent enough to confuse a series of tests, or could be guarded against.

Mr. Irwin and the professors seemed to see the inadequacy of the twirling theory, and they threshed out in vain the falling of various bodies through mediums of various densities (reported in *Collier's Weekly*). I would suggest the fact that all bodies falling through a medium near their own density are liable to deviate, as a feather or ping-pong ball in the air, or a billiard ball or marble in water when it gets down where the water is nearer the density of the ball. But the air is nothing like so dense as a baseball. And we know that the thrown baseball does not slow up like those falling balls. The theory of air compression was discarded.

Can we suppose that if projected balls were given to unaccountable deviations gun practice would be so reliable and accurate as it is?

The revolving of a ball on its course causes deviation. But how much? A rifle ball is revolved on a plane perpendicular to the course to keep it straight. We will only note here that it requires a tremendous explosive force to do it. A cricket ball is not pitched as fast as a baseball, and a little twirl when it strikes the ground will deviate the rebound some. A tennis ball is smaller, has a frictional surface (purposely), and the racket has a broad and very rough face, so that by a slanting, grinding blow the ball can be made to revolve with great rapidity, and the grind on the ground will give a greater deviation still. A golf ball is small, trenched or corrugated, and when hammered with a hard club, so much heavier than itself, with a slanting stroke, it will spin and curve considerably in its long flights. The wind also has quite a chance at it, too. The billiard ball receives a shot-like, longitudinal impact from the cue and twirls on the frictional cloth, and being heavy, retains its motion the longer. A baseball hammered by a bat on one side, that is, a heavily batted foul, will spin considerably. Now, a baseball has no ground or cloth table-cover to spin against. And to compare its revolutions in the air with those other balls we will have to imagine a baseball fired from a rifled cannon, or hammered by a golf club several times its weight, wielded by a giant, and allowed to soar a long distance, or by a giant tennis racket, etc. It would require a human hand of steel, swivel wrist, and explosive revolution; a kind of "double million magnifying glass" gyroscope, as Sam Weller might say. But anyone can get some idea of what a hand can do in revolving a baseball. Color part of a ball, so as to see better, and let watchers stand near the line along which the twirler pitches the ball. Anyhow, if it spins rapidly it will not always stop on striking the ground, and some of its spinning will be seen. Then there is the handicap of making it revolve to the right or left, up or down, and all in addition to the strain of control and speed, without which the best pitcher will be batted all over the grounds. A practical question is, is it wise for a pitcher to additionally strain and distract himself by that which is not yet systematically tried out and reported? And, by fuller facts, theories of explanation ought to be helped. One of these is that friction of the air on the side of the ball revolving forward is greater than on the side revolving backward, and acts as a brake to swerve the ball to the forward revolving side. I knew the head of a high school who held this theory, but taught the pitchers to twist the nose of the ball in the direction he wanted it to curve. The Bernoulli theory is that the side of the greatest velocity is the side of the least pressure from without. Is not the side of the greatest velocity the side of the ball that is revolving forward in the direction of the ball's flight? And is not the side revolving backward the side where the air goes by the ball less rapidly, the side of the greatest pressure from without? According to the theory, the ball would be pushed to the side revolving forward, the side of less pressure. But Prof. Franklin seems to me to draw the opposite conclusion.

Suppose a pitched ball is revolving nose to the left. Pressure and purchase being greater in front than behind, it would seem that the ball would claw or work itself to the right. Also, the right being the side of greatest velocity, least pressure, the ball would tend to the right, by the Bernoulli theory. These forces might be true and yet overbalanced by a third and greater force, which we may call the wedge. The surface of the revolving ball on the left front quarter is by friction sweeping the air out of the way and backward, while on the right front quarter it is sweeping the surface air inward and forward against the oncoming air, so that the greater resistance pressure on that quarter wedges the ball over to the left. As a ship moves forward, if there is a little more floating ice on one bow it will tend to wedge the bow over to the other side.

I repeat for emphasis (1) most of what we believe is from hearsay; (2) that those who only say "I have seen it" should consider that, for one to see and know the curves in question, he would have to know just where the plane of the parabola is and have his eye there; (3) optical illusion is more common than the unscientific imagine and seems to have been ignored in this discussion; (4) a testing place, carried on for a reasonable time, would be a benefit to players and science.

S. C. THOMPSON.

Ocoee, Fla.

The Current Supplement

A NEW device for measuring stellar radiation, described in the current issue of the SUPPLEMENT, No. 2015, appears to make possible more extended investigations in an interesting field.—The Westinghouse turbine reducing gear is described, and the ingenious construction that has made it practical is fully illustrated.—Sir Ray Lankester tells how to get struck by lightning, and how not to, including much useful information about lightning.—In the riddle of Mars the theory of the canals is discussed from a new point of view.—Some important harbor improvements in the Island of St. Thomas are described and fully illustrated.—The first contest for safety of aeroplanes, at Paris, tells the story of what the Sperry gyro stabilizer did, and an illustration of the apparatus is given.—Recording moonlight and night cloudiness calls attention to an entirely neglected branch of atmospheric observations and records. Other articles discuss the protection of battleships against submarines; the geological action of man in changing the topography of the earth, and a survey of the manufacture of alcohol from wood refuse.

What It Costs to Kill a Man in War

WHEN the Lane Medical Library of Stanford University was dedicated on November 3rd, 1912, *Dr. David Starr Jordan* delivered an address, in which he stated: "In modern war, it now costs on the average about $15,000 to kill a man. In the late Boer war, this expense ran up to nearly $40,000. It is cheaper to save men. It is cheaper to stop killing. In our own country, in the time of peace, when nothing but peace is possible among civilized nations we spend nearly a million dollars a day on matters concerned with past or future wars; $850,000 a day, on future wars alone, that we may not be caught napping when the day of the impossible shall arrive."

Blériot and His Supposed Transatlantic Machine

THERE recently appeared in the daily press a statement, credited to Mr. Arnold Kruckman, that Louis Blériot is building a four-motor transatlantic machine. Immediately upon the publication of this announcement, we requested our Paris aeronautic correspondent, Mr. John J. Ide, to investigate the matter. He forwards us a communication from Blériot, in which it is stated: "I have not the slightest intention of constructing a machine for crossing the Atlantic, and still less for a journey around the world. I know nothing at all of the apparatus to which you refer."

Surveying with an Automobile Truck.—In extensive surveys to be made this summer by the Coast and Geodetic Survey and the Geological Survey, between Barstow, Tex., and the Pacific Ocean, an automobile truck will be used for transportation, in place of horses and wagons. A special machine is used for the purpose, equipped with solid rubber tires, dual behind, and extra tanks for gasoline and water. The same plan was tried with great success in two previous seasons; last year, in surveying between Denver and the Canadian border, it was estimated that the expense of this mode of transportation was about half of what it would have been if horses and wagons had been used.

German Artillery in the War

ARTILLERY has always played an important part in the military operations of the German army. According to the latest figures available which may be taken as of 1912, Germany had 3,866 field guns against 2,936 for France, 1,854 for Austria. Russia seems to have been a pretty good customer of the German gun shops, for she has no less than 4,432 field guns. England, with 1,170 field guns, is outclassed by Italy with 1,470 guns. German artillery is in the front rank, and the great Krupp establishment is one of the industrial wonders of the world. Now we have the supreme test when Krupp rifle and mortar are pitted against the products of the best English and French ordnance factories.

German artillery has already shown great efficiency, and it is probable that the fate of the present war on land will be largely dependent on field and siege guns. Siege operations are usually long drawn out on account of the time required in changing the solid firing platform as the lines around the invested city or fort are drawn closer.

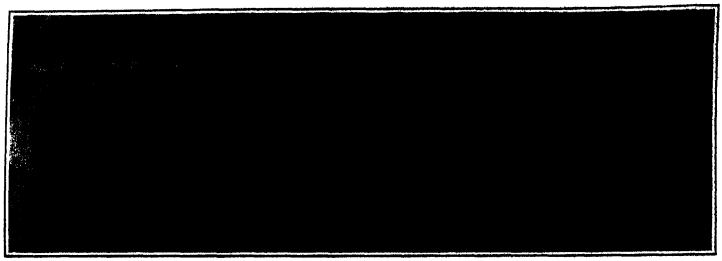
Realizing this deficiency in mobility, the Krupp firm has designed a new type of mortar of this character, the salient feature of which is that it is mounted upon a gun carriage, so that it can be moved from point to point, and can even be attached to the artillery in field operations. This end is achieved without any sacrifice of ballistic efficiency, by the application of a long invariable recoil, and by the employment of wheels fitted with feet after the manner of the Diplock pedrail.

The Krupp designation of this piece as a howitzer is to distinguish it from the mortar proper, reserving the latter title for those weapons able to fire at an angle exceeding 45 degrees. This new arm has a greater variation in its elevation, so that it really is more flexible in use. The two terms, however, are now so generally confounded that it may be classed as a mortar.

The barrel is made of steel, and comprises the inner bore and a jacket, the total length being 11 feet. The carriage upon which the arm is mounted comprises in reality two vehicles. The barrel or mortar proper is carried upon one carriage, while the other carries the mounting with the recoil brake and the two air reservoirs. In transport the two pieces are hauled separately, the main wheels of each carriage being shod with feet, so as to permit passage over soft ground without sinking, while haulage is carried out by gasoline motor cars, as being more suited to the work than horses. Upon arriving at the position of firing, the mounting carriage is planted first, and then the second carriage is moved up from the rear, until the bore is in line with the cradle of the mounting. By means of thin wire cables and pulleys the mortar is pulled from its own carriage, and slides over special guides through the opening in the second carriage, until it is in the designed position, where it is made fast and connected up. The second carriage is then withdrawn, leaving the arm complete upon the mounting carriage and ready for firing.

The training gear gives a maximum elevation to the mortar of 65 degrees and works upon a rapid system. The weapon can also be moved 5 degrees on either side in the horizontal plane. The upper part of the cradle into which the bore slides carries a group of three cylinders. The central cylinder is the recoil brake,

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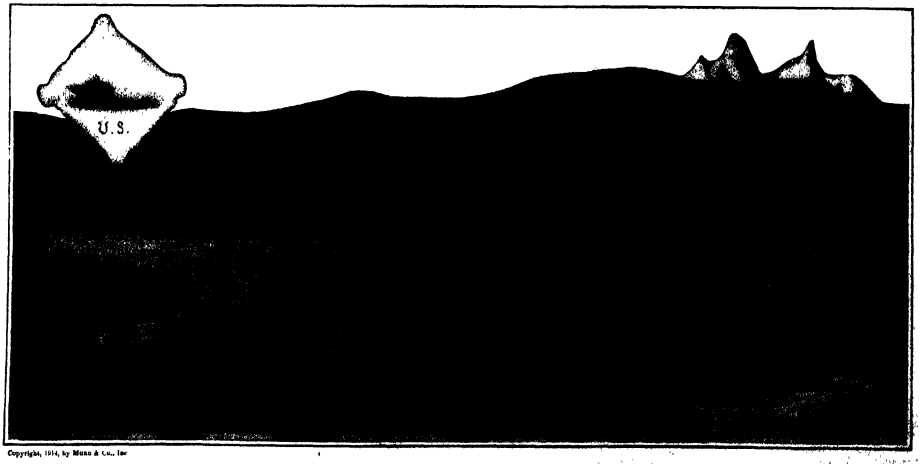


The 11-inch howitzer is hauled by cars.

Bore, 11 inches; length, 11 feet; shell, 386 pounds; powder, 88 pounds; maximum elevation, 65 degrees; maximum range at 65 degrees, 24,278 feet; maximum range at 42½ degrees, 33,185 feet.



Transporting part of the mounting of a powerful mortar by motor car. Gun and mounting are assembled where fired.



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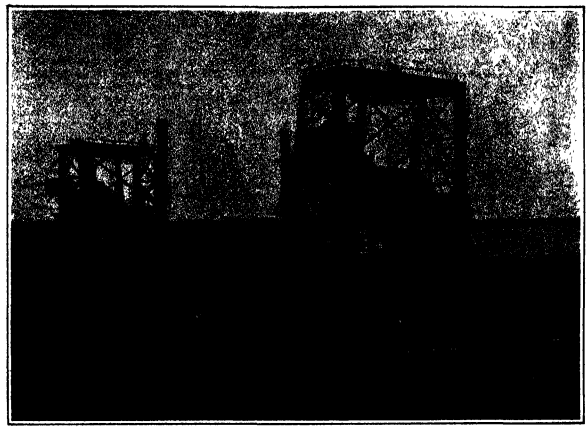
A graphical comparison of the artillery of the principal powers at war and the United States.

The Unloading of Coal From and To Vessels

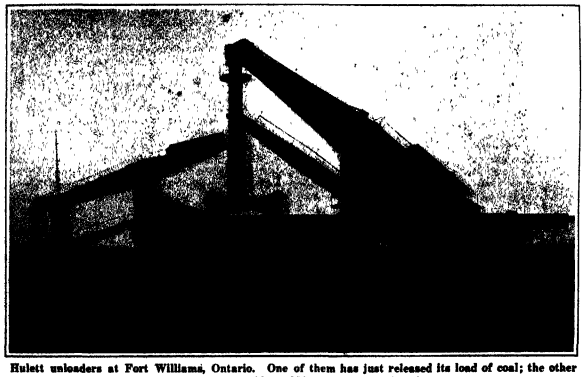
By J. V. Springer

WHAT is perhaps the most up-to-date method of unloading coal from a vessel is used in an installation at Fort Williams, Ont. For a number of years, the Hulett unloader has been in use in the United States in connection with the unloading of iron ore, especially from whaleback vessels. This same device constitutes the principal feature of the plant at Fort Williams.

Briefly, such an unloader consists of an immense beam pivoted near the center in such a way as to permit a movement in a vertical plane. At one end—the working end—a vertical leg is pivoted, at the bottom of which is the device for seizing a quantity of the material which is to be handled. At the other, or non-working end, is located the cab of the general operator. This man controls the vertical movements by which the vertical leg is let down through a hatchway into the hold and later on withdrawn, the load having been secured in the meantime. There is a loading operator who occupies a position in the lower part of the vertical leg and who manages the movements of the bucket which reaches out and gets the load. He is able to cause the bucket to swing round in an arc and to extend itself. So perfect is the whole operation that it has been found possible to secure mechanically up to 97 per cent of the load of iron ore. The entire apparatus, rocking beam and all, is supported on a carriage capable of movement on a second carriage underneath it. This "foundation" carriage may be moved back and forth on suitable tracks on the dock parallel to the length of the vessel. The carriage to which the rocking arm is pivoted has a longitudinal movement perpendicular to this. By counting all possible movements, the unloader may be made to operate everywhere in the hold—fore and aft, port and starboard, high and low. The great efficiency of these machines with iron ore has no doubt been the reason why they are now being adopted for use with coal.



Car dumper in action at a South Amboy pier, New York harbor.



Hulett unloaders at Fort Williams, Ontario. One of them has just released its load of coal; the other is down in the hold, grabbing eight tons of coal.

The Fort Williams plant is equipped with two unloaders, each capable of securing an 8-ton load of coal. There is in addition a rehandling and stocking bridge having a length of 475 feet. The unloading equipment is at the front of the dock. After an unloader has secured its load, the latter is discharged into a conveyor car belonging to the unloader. This car is discharged into either the scale lorries preparatory to a discharge into the bins or into a storage pit. There are thirty bins arranged in two parallel rows of fifteen each.

The cars to be loaded are run beneath the bins on two tracks at a lower level. Thirty cars may thus be loaded at one setting. It is not necessary that they be loaded simultaneously with the unloading of the vessel.

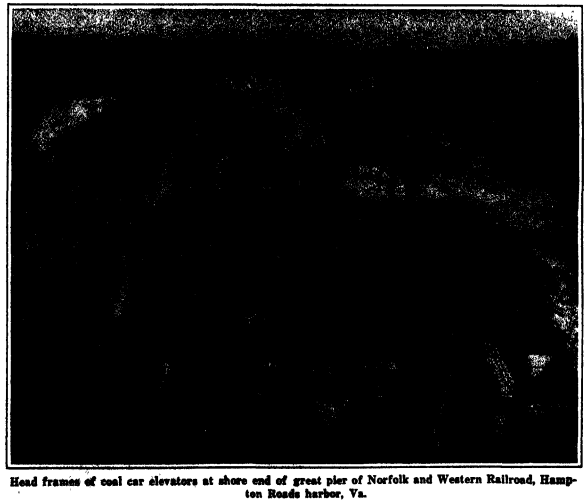
It is said that a vessel having a load of 12,000 tons may be unloaded by one of the unloaders in about twelve hours, the capacity of the unloaders being 450 or 500 tons per hour.

The reverse procedure, that of transferring coal to a vessel, might not seem at first blush to involve any special difficulty. However, the amounts to be handled are so enormous and economy of time and operation are so important that the most highly perfected methods of to-day have been the result of a long period of development. The most up-to-date provisions are to be found no doubt upon our Atlantic Coast. Here we have four harbors—New York, Philadelphia, Baltimore, and Norfolk—which are already provided with fifty-six coaling plants, and in two of which four more plants are under construction. In New York harbor alone, there are thirteen separate ports and twenty-nine coaling plants. In the year 1911, a total of 1,000,000 carloads of coal were discharged by the coaling plants of these four harbors into vessels of various types. These four harbors have a daily coaling capacity of more than 11,000 carloads, although none ever operates at capacity for any considerable length of time.

The coal is handled in various ways. In many cases, it never encounters anything which would usually be termed a mechanical device. In others, the mechanical apparatus is a very prominent feature. In still others, there is a combination of mechanical devices and pier operation.

Indeed, one may choose to regard the arrangement of the levels and grades of a pier and of the storage bins and discharge chutes as a gigantic piece of apparatus, the whole being run by locomotives and gravitation. And who could deny that we have here the essentials of a machine? In one case, you will have the railway tracks on a pier arranged on a gentle up-grade as the outer or sea-end is approached. The loaded coal cars are simply pushed out onto the pier by a locomotive operating from the rear. When the cars have been discharged into the bins beneath the tracks, the down-grade toward the shore end becomes of service

(Concluded on page 122.)



Head frames of coal car elevators at shore end of great pier of Norfolk and Western Railroad, Hampton Roads harbor, Va.

Searchlights of the German Fleet

THERE is no use in having powerful and efficient arc lamps if the light is not reflected by mirrors of the proper section and polish; and in this respect a German inventor has succeeded in producing grinding machinery that will turn out perfect parabolic mirrors of any desired diameter, and of a wonderfully fine polish. The largest of these mirrors, 2 meters, or say 6.56 feet, in diameter, acting on a source of light of 440,000,000 candle-power, will illuminate large objects in favorable weather so that they may be distinguished at a distance of 18.5 kilometers, or 11.5 miles; and their light has been seen at a distance of 400 kilometers, equal to nearly 250 miles. The accompanying photograph shows a searchlight display of the German fleet in the harbor of Kiel.



German fleet turning night into day.

Hearing Type

A NEW form of optophone constructed to enable totally blind persons to read ordinary books and newspapers, by means of the ear, has been invented by Dr. E. E. Fournier d'Albe. A perforated disk rotates in front of a Nernst lamp, and produces a bright line consisting of dots giving flashes of different musical frequencies. An image of this line is thrown on the type, which reflects the light upon a selenium bridge. Each letter gives a characteristic sound, which is heard by means of a telephone attached to a Brown telephone relay.

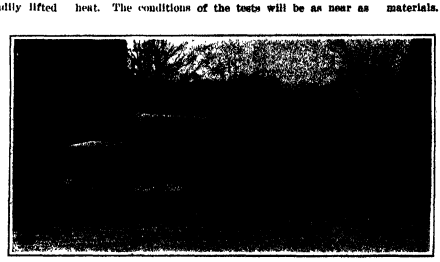
Aeroplane Motor Cars for the Russian Army

A LARGE number of motor cars, designed to comply with special requirements, were recently supplied to the Russian army by a prominent Swiss firm. These comprise a complete aeroplane squadron, ambulance vehicles and a workshop car. The touring cars of the aeroplane squadron are mainly intended to serve as means of rapid conveyance for the officers, a special feature being that they carry two folding stretchers which, in cases of emergency, are readily lifted into the car from the rear. Each car is designed as a tractor for an aeroplane-carrying trailer, and accordingly is fitted at the rear end of the frame with a spring draw-bar and suspension device for a two-wheeled trailer. In one of our photographs we show an aeroplane motor unit in which the tractor is a motor truck designed for a load of two tons. The wooden arches of the body are designed to be lowered, thus reducing at will the total height of the vehicle, so that it will pass through tunnels when transferred to railway cars. The two-wheeled trailer, as shown in the photograph, is at the front end fitted with four resilient diagonal stays, joined in a pyramid at the point of suspension, so that an entirely safe and elastic connection between the tractor and aeroplane carrier is insured.

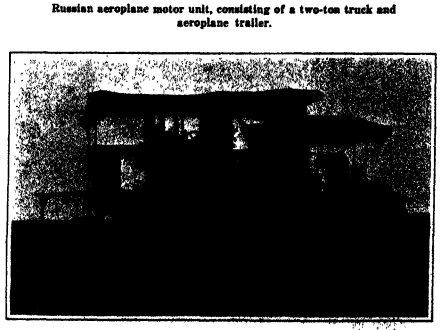
The aeroplane carrier contains a number of interesting constructional features. Its dimensions far exceed the usual limits, the bridge body being about 25 feet long by 7 feet wide, and nearly 10 feet in clear height. The aeroplane to be transported can thus be introduced without dismounting anything (apart from the planes). The height of the vehicle can, however, be reduced as required by lowering the wooden arches. The platform rises only to a height of about 16 inches above the ground, thus allowing aeroplanes to be introduced in as simple and convenient a manner as possible. As the suspension device in front of the aeroplane can be removed, aeroplanes can be loaded at will from the front or rear.

Our other photograph shows a transportable repair shop. In view of the constant additions to the automobiles owned by army authorities, a want has been keenly felt for such transportable repair shops allowing any repair work on motor cars or aeroplanes to be done in the field. The very substantial body of the car, which is mounted on a 3½-ton chassis equipped with a 30 horse-power motor, has a sailcloth roofing. The upper halves of the side and rear walls likewise consist of sailcloth, while the lower halves are substantial planks, which can be folded down to form a platform on which the men can work. The equipment comprises a lathe, drill, band saw, milling machine, field smithy and anvil, carpenter's bench, etc.

The machinery is designed for hand as well as electric operation by means of a dynamo installed in the car. This dynamo is driven directly from the motor of the chassis through a silent-tooth chain-drive, and can be thrown in and out at will. The total weight of the vehicle, inclusive of its equipment, is about six thousand kilogrammes.



Russian aeroplane motor unit, consisting of a two-ton truck and aeroplane trailer.



A motor repair car of the Russian aeroplane corps.

Bureau of Standards Furnace for Testing Building Materials

By Hartley M. Phelps

WHAT is probably the most efficient furnace for the testing of the fire-resisting qualities of building materials ever constructed in this country is being completed by the United States Government at the Pittsburgh, Pa., station of the Bureau of Standards. It is also to be used for load-testing under immense heat. The conditions of the tests will be as near as possible those obtaining at a fire, and where streams of water are being played on the heated material. For the housing of the furnace a building of light structural iron framework on which are sheets of corrugated iron for the walls, has been erected; the building and furnace representing a cost of about $5,000.

The Government is a large consumer of all kinds of building materials; so it is of the utmost importance to Uncle Sam to know just what these materials will stand in the way of wear and test under all kinds of conditions. In the new furnace such commodities as brick, tile and hollow-tile material; gypsum and cement blocks; concrete, metal laths, and other forms of structural substances will be exhaustively tested under various heats. Standards of heat endurance will be ascertained and formulated for all refractories. Such valuable information to contractors and those contemplating building is made available through the bulletins published by the Bureau from time to time.

The furnace is in the form of a parallelogram, and is built of fire-brick, two big piers of solid brick taking up the lower part of the interior. There is an ingenious system of flues, the heat being applied by burners in which natural gas, mixed with compressed air, is burned. One side of the inclosure is open, and here a panel 8 by 6 feet is built up of the material which is to be tested, the panel, held in an iron frame suspended from I-beam travelers, forming in fact the other wall of the furnace. By suspending it the panel may be moved away from the furnace and tested for the action of water, which is sent against it through a hose or several streams.

A feature of the work will be the testing of safes and filing cabinets to see whether papers contained in them are damaged by fire. Any manufacturer may send such objects and have them tested free if such testing is in line with the work being done by the Government.

For the testing of loads under high heat the material to be tested—a column of concrete, cement, etc.—is placed on the brick piers, and on top of the material hydraulic jacks of great power are set. These jacks exert both a downward and an upward pressure, the upper pressure being against a heavy steel beam.

The furnace is to be in charge of Walter A. Hull, expert in testing fire-resisting qualities of building materials. He entered the Government service recently, after wide experience in fire-brick plants in the South and elsewhere. P. H. Bates is head of the Bureau of Standards branch at Pittsburgh.

Schaumann Armor Plate

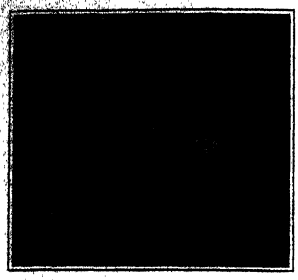
FOR several years the German naval administration has been experimenting with a new type of armor plate, invented by the Koenigsberg engineer, Schaumann, which appears to possess considerable merit. The special advantages claimed for it, in comparison with other armor plate, include diminished cost of production, reduction of weight by one half, and increased power of resistance to projectiles. The Schaumann plate is not homogeneous, but is composed of an outer plate of nickel steel and an inner plate of soft metal, connected with each other at intervals. When the outer plate is struck by a shot, it is not perforated because the inelastic backing prevents it from yielding beyond its elastic limit.

The *Kriegstechnische Zeitschrift* describes experiments in which Schaumann armor plates were repeatedly subjected to the impact of projectiles of the "S" type. These projectiles, fired from a distance of 500 meters, perforate a 3½-millimeter plate of nickel steel, but produce little effect on a Schaumann compound plate of the same weight, composed of 2 millimeters of nickel steel and 3 millimeters of soft metal.

A Schaumann plate composed of 2½ millimeters of nickel steel and 5 millimeters of soft metal is not perforated even when the range is shortened to 75 meters. Schaumann plates are particularly well adapted for army use, as they are light enough to be used in the construction of shields for machine guns, and even perhaps for rifles, as well as for field pieces. The shields now used for field pieces are 3 to 5 millimeters thick and weigh 50 to 90 kilogrammes, and a reduction of weight is desirable in the interest of portability. The Schaumann plates successfully resist infantry fire at very close range, and they will probably afford good protection against shrapnel. The experiments hitherto published were made with plates of small thickness. The superiority for thick armor plates remains to be proven.

A Mathematical Dog

Reference has appeared at fairly frequent intervals in the daily press of the remarkable feats performed by various "talking" animals. The most famous of these



Hector, the canine mathematician.

are, no doubt, the Elberfeld horses. Quite recently the editors of the SCIENTIFIC AMERICAN were given an opportunity to make direct observations on Hector, Mr. C. J. Tryon's French poodle, of "mathematical" propensities. The dog performs a number of ordinary tasks, in addition to his exercises in "mental arithmetic." One notable feature is that he correctly obeys instructions spoken in an ordinary tone of voice, without special emphasis on key-words, and rather complicated in character. Thus, for example, he correctly followed out the programme when told to walk around a chair (on his hind legs), to stop when he got to the back of the chair, to bark at his master, and then to come all the way round and sit up on his haunches. He would upset one of the editorial waste paper baskets (very needful articles of furniture here) either by pulling it over with his paw, or by pushing it over with his nose, according to orders.

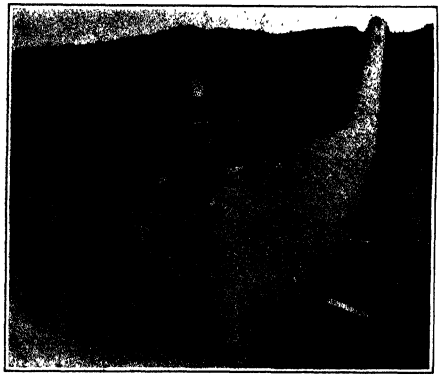
But these tricks might be duplicated by other performing dogs. The wonderful part of Hector's performances is his figuring of sums. He has before him an electric bell, behind which he sits at attention. A sum is given him to do, such as, for example, "what is 3 times 6?" The dog pauses, apparently in thought, with half-closed eyes, and presently, with his eyes intent on his master, he taps out 18 on the contact key of his bell. It is not necessary for his master to face the dog. In most cases he stood with his back to the dog, some fifteen or twenty feet away. It is not even necessary for the sum to be stated aloud. Apparently the dog gets his clue by a species of thought-transference. In several instances the sum to be figured was stated in a whisper to Mr. Tryon, and presently the correct answer came from the key. The dog taps out the answer so rapidly that it is sometimes quite difficult to follow in counting the strokes. Errors were occasionally, but very rarely, made, usually taking the form of one or two strokes in excess of the correct answer. He gave answers in addition, subtraction, and multiplication.

A written account, such as this, of the dog's performance is wonderful enough, but there are features in the phenomenon which have to be seen to be fully appreciated. The dog behaves very much like a person performing so-called thought-reading. Inasmuch as the true nature of this is still somewhat a matter of dispute, it is only natural that the dog's performances should seem somewhat obscure. This much can be said, that so-called thought-reading, at least in some forms, demands little or no thought on the part of the medium, so that there is no obvious reason why an animal should not be capable of functioning in this capacity as well as a human being.

It may perhaps seem unnecessary to furnish a demonstration that the dog does not actually work out the sums given him to do, though some rather thoughtful persons seem to consider such a thing possible. Such demonstration was, however, furnished at the séance given by Mr. Tryon at the office of the SCIENTIFIC AMERICAN. It was proposed to give him something difficult to do, so he was asked to find the square root of nine. He correctly rang out: Three. Now he had never heard the words square root before. The greatest mathematician that ever lived could not solve a problem stated to him in an unknown tongue. If the dog succeeded, this cannot be because of great mathematical powers, but because he finds the answer by a process entirely independent of mathematical reasoning on his part. It must be thought-transference of some kind—whether by almost imperceptible signs unconsciously given by his master or by some occult process not within the range of present-day psychology; that is a question which we will leave undiscussed. Hector is not a stage performer. He has been taught and trained by Mr. Tryon, who is a mining engineer from Arizona.

Motoring on a Tube

A FEAT that called for not a little nerve was performed when an automobile enthusiast recently drove his car up the siphon of the Los Angeles aqueduct, across Bouquet Cañon. He made the trip of one mile in good time and without mishap, but it required a steady hand and a cool head to keep a perfect balance astride the big tube. A slight swerve, particularly where a heavily riveted joint broke the smooth surface, would have a tendency to send the machine skidding over the side. The trip would not have been so difficult of accomplishment were the course of the aqueduct level, but in many places a grade of 10 per cent had to be negotiated, and there it was no simple task to keep the machine on the excessively crowned roadway. From the size of the tube, as shown in the illustration, a fall from the top would be disastrous.



Driving a motor car over the Bouquet Cañon siphon of the Los Angeles aqueduct.

New Stretcher for the French Navy

A NOVEL stretcher for transferring the wounded and injured has been introduced in the French navy and tried out successfully during the maneuvers in the Mediterranean. The apparatus consists of metal and is of such shape that the body rests in it comfortably and will not be disturbed while the stretcher is transferred from the ship to a launch and from there to the hospital ship, even though the stretcher be tipped until the wounded man occupies a sitting posture. It is strongly built, and will not break or give if it should be thrown against the ship's side while being swung out. A prop under the upper end of the stretcher keeps the head higher than the feet. Such a stretcher is a vast improvement over the ordinary canvas conveyor, which permits constant changes in the position of the body.

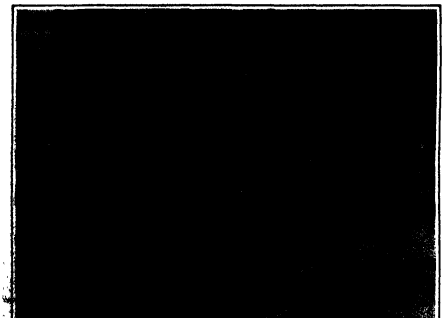


New stretcher used by the French navy.

The "Whip" at Luna Park

CONEY ISLAND is easily the most popular seaside resort in the world, and an attempt has been made within the last year to extirpate all objectionable elements, and we are glad to say that success has crowned the efforts of the reformers. The existence of huge amusement parks like Luna Park goes a long way toward raising the tone of a resort. In this unique inclosure some sixty shows and concessions serve to pass away the visitor's time in an agreeable manner.

The latest amusement device installed in the Park is called "The Whip," and is the invention of Mr. William F. Mangels, a well-known designer of carrousels and similar devices. In an inclosure is a track having alternate straight portions and turns, curves or corners, upon which track run cars propelled by an endless chain to which the cars are independently connected, so that each car will travel along the straight portions of the track and acquire a quick, centrifugal motion in passing around the curves, turns, or corners, the suddenness of which causes agitation or commotion of the occupants, and hence much merriment and amusement, and as the car passes the turn it again takes up a trailing position until another turn is encountered. The endless chain has a constant speed of travel, but the speed at the corners is variable, like the cracking of a whip. Means are provided so that the free play of the car is limited as it passes the corners. A sprocket wheel at one end serves to actuate the chain, an electric motor in turn driving the sprocket wheel. "The Whip" vies with the "Witching Waves," which we have already illustrated, with being the most popular amusement devices on the Island.



"The Whip" at Luna Park, Coney Island.
The cars are "snapped" at the corners by centrifugal force.

Over the Alps With a Passenger

THE greatest flight across the Alps with a passenger was made on July 27th by the Italian aviator Landini, accompanied by Dr Lampugnani. A monoplane was used, the start being made from Novara at 5 o'clock A. M., and, passing over Monte Rosa, which is 15,217 feet high, Viege was reached at 7 50, a distance of a hundred miles. The aviators suffered intensely from cold, and were twice lost in the clouds.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

Sterilizing the Water of Swimming Pools with Ultra-violet Rays

By Dr. Max von Recklinghausen

IT is a common practice to circulate the water used for swimming pools through a filter so as to remove the impurities which are imparted to it by bathers, and then to conduct the water, thus purified, back to the swimming tank. This simple filtration process, however, is hardly sufficient to purify the water to such an extent that it will surely be harmless. With present methods it is impossible to eliminate disease-producing bacteria—an end which can be obtained with a filter only if the water is circulated with sufficient rapidity through the purifying system.

That the water of our swimming pools, however carefully filtered, is anything but pure and free from bacteria is evidenced by some tests which have been made in one of the large modern Y. M. C. A. swimming pools in New York city. These tests showed that the bacteria count near the outlet of the purifying apparatus revealed many thousand bacteria per cubic centimeter, and among these bacteria were some of intestinal origin. This swimming pool has lately been provided with a modern sterilizer in which the ultra-violet ray is employed. The apparatus, as the accompanying illustration shows, consists of a flume into which two quartz tubes protrude. Two 220-volt, 2.2-ampere mercury-vapor lamps known as "pistol lamps," because of their characteristic shape, furnish the necessary ultra-violet radiation to the water. The water is continually taken from the bottom of the tank and made to pass very rapidly through a filter in order to remove any suspended matter which may have been brought in by the bathers. It then passes through the ultra-violet sterilizer. The water which leaves the tank, instead of containing many thousand germs per cubic centimeter, contains only about one twentieth of that number; moreover, all bacteria of intestinal origin are absolutely killed. In this way the same water can be used over and over again for weeks and months at a time without any danger of disease.



How the water in a swimming tank is purified by ultra-violet rays.

Thus the remarkable germicidal properties of ultra-violet rays are applied in a remarkably practical way.

Baltimore's Car-ferry

By Harry C. Plummer

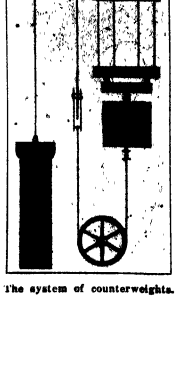
TO relieve traffic congestion on the electrically operated four-mile belt-line maintained by the Baltimore and Ohio Railroad, in the city of Baltimore, which is in constant use for both passenger and freight service, that company has restored the car-ferry which formerly was in operation between Locust Point and Canton, on opposite sides of Baltimore harbor, and which the belt-line was built to supersede. The twentieth century restoration of the nineteenth century car-ferry has entailed not only the purchase of new car-float equipment, but the building of a special type of steel transfer bridge, which has been both dictated and facilitated by the peculiar physical and traffic conditions existing in the harbor of the Maryland metropolis.

Several large car-floats have been put into operation in the new freight ferry-service, and the company recently placed a contract for two steel car-floats with a capacity of fourteen cars each. The latest transfer bridge was designed by the railroad's engineering department, under the supervision of F. L. Stuart, chief engineer, and W. S. Bouton, engineer of bridges. A noteworthy feature of the new bridge is the provision of a system of pick-up counterweights which, as the outer end of the bridge settles with the coming on to the span of the live-load, comes into action and takes up the load reaction of the bridge at the water-end. This, otherwise, would come upon the barge.

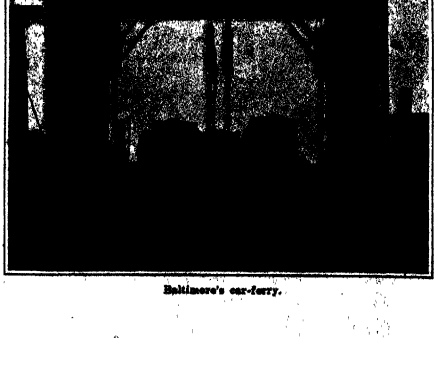
Heretofore the steel construction of transfer-bridges has been virtually impossible. It invariably happens that during the process of loading or unloading, one side of both bridge and barge is weighted down, while the other is "light." This necessarily causes the bridge to be warped and twisted transversely.

The Baltimore bridge, as constructed, consists of two single track through-plate girders, with one span supporting each track. The land end of these girders is hinged around a 5-inch pin, and the outer end is suspended by an overhead structure. By this arrangement the load is transferred from the bridge to the dead-load counterweight by means of wire cables. A system of pick-up counterweights overcomes the settlement, which would naturally result from the coming onto the span of the live load, and which would submerge the land-end of the barge and lift the outer end from the water. There are two 1⅛-inch cables extending from the bottom of the dead-load counterweight around the sheaves. These cables are fastened to the sheave-blocks and form a fixed relation between the sheave and the dead-load counterweight. If the latter is raised or lowered, the sheave is raised or lowered in a like degree.

From the pile of pick-up counterweights a wire cable is run up over one sheave and down around another and up into the machinery house atop of the structure, at which point it is attached to a drum. The bridge is operated by electric motors located in the machinery house. To overcome the listing of the barge to the loaded side thereof, two tilting hoods have been provided. To these, which are pinned at the center, so that they may be revolved in a vertical plane about the 15¼-inch pin, the barge is attached by toggle-bars.



The system of counterweights.



Baltimore's car-ferry.

A Patent for a Street Railroad Transfer Ticket.

—Inventions involving the arrangement of printed matter upon a page or sheet of paper are always difficult to define and distinguish in a patentable sense. The case of Cincinnati Traction Company v. Pope, decided by Circuit Judge Knappen of the Sixth Circuit, in sustaining the Pope patent for a time limit transfer ticket holds that a patentable invention is disclosed, and that the term "manufacture" as used in the patent law has a very comprehensive sense, embracing whatever is made by the art or industry of man, not being a machine, a composition of matter, or a design. The defendants argued that the patent relates merely to a method of transacting business, a form of contract, a mode of procedure, a rule of conduct, a principle or idea, or a permissive function predicated upon a thing involving no structural law. It was urged that "the ticket in question has no physical characteristics which enable it to be distinguished from any other transfer ticket or from any other printed slip of paper." The Court, after referring to the case of Rand, McNally & Co. v. Exchange Scrip-Book Company, said that the language of Judge Grosscup seemed particularly applicable, wherein the judge said: "The ticket patented is not a method at all, but a physical, tangible facility without which the method would have been impracticable, and with which it is practicable." The Court also quoted the language of another Judge, who said, "The fact that the structure may be of cardboard with printed matter upon it does not exclude the device from patentability according to the Patent Office."

RECENTLY PATENTED INVENTIONS

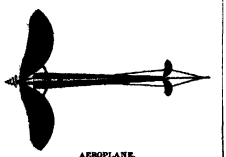
Those inventors are open to all suggestions. The services are inspired by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

BUCKLE.—J. F. DUNN, New York, N. Y. The object of the present invention is to form a buckle for belts, the construction whereof is simplified and cheapened. This construction in its simplicity and openness of structure lends itself readily to any desired form or finish, such as plating, lacquering, or similar process.

Pertaining to Aviation.

AEROPLANE.—H. MANSON-OLIN, 414 Union St., Brooklyn, N. Y. An object here is to provide an aeroplane having rigid supporting surfaces disposed one above the other. Another is to provide an aeroplane having laterally extending wings maintainable rigidly in a hori-



AEROPLANE.

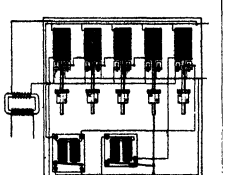
zontal plane, and capable of rotation in this plane, whereby the device may be automatically stabilized. A further object is to provide an aeroplane having automatic stabilizing devices coacting with steering and balancing devices.

Electrical Devices.

ELECTRICAL FITTING.—M. F. FINKELSTEIN, 84 Walker St., New York, N. Y. This device is for use in connecting the ends of wire or like conductors, and comprises an insulating body, conductor-receiving and holding means within the body, means for electrically connecting the conductors, and a guard for the last-mentioned means, movable longitudinally of the device, into an operative and into an inoperative position.

ELECTRIC FITTING FOR CIRCUIT WIRING.—M. F. FINKELSTEIN, 84 Walker St., New York, N. Y. This invention provides a fitting which can be fashioned from different materials adapted for the purpose, which is susceptible of a variety of uses, by means of which electric conductors may be readily and securely connected, by means of which the electrical connection effected is an excellent one, and which can be easily manipulated.

AUTOMATIC STARTING BOX.—M. E. CURTIS, Box 14, Carbonado, Wash. Mr. Curtis's invention relates to automatic starting boxes of the kind used in connection with electric cars or other electrically driven machin-

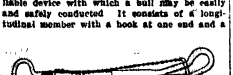


AUTOMATIC STARTING BOX.

ery, or with electric lamps for the purpose of first causing a small flow of current through the main or power circuit, and then increasing the flow step by step until the current reaches its normal or working power.

Of Interest to Farmers.

BULL STAFF.—W. T. SHERMAN, Peru, N. Y. This invention provides an inexpensive and reliable device with which a bull may be easily and safely conducted. It consists of a longitudinal member with a hook at one end and a



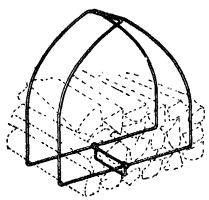
BULL STAFF.

handle at the other. A spring latch normally closes the gap of the hook, and a chain running from the latch to the handle provides means for opening the gap when desired.

BUNDLE SUPPORTER FOR THRESHERS.—F. POWERS, Carlisle, Neb. The invention relates to self-feeders of threshing machines, and particularly to an attachment adapted to be applied to self-feeders of known make whereby to support the bundles at the lower end of the self-feeder, and provided with means for adjusting the width of the attachment to suit different self-feeders.

Of General Interest.

CARRIER.—J. NILSON, R. F. D. No. 2, Box 65, Clearbrook, Minn. This invention relates more particularly to a carrier especially adapted for use in handling sawed and split wood in order to avoid the necessity of carrying such wood in the arms, and thus filling

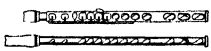


STOVE WOOD CARRIER.

the clothes with dirt and splinters. In use the carrier is partially filled with the wood or like articles, resting on the straight lower portions of the frames, as shown in the engraving, and confined between the upstanding side portions of these frames.

WOOD WIND INSTRUMENT.—N. ALBERTI, 2227 Hisell St., Chicago, Ill. An object of this invention is to provide means for tuning wind instruments, such as flutes, clarinets, and the like. A further object is to provide means for simultaneously changing the pitch of the notes produced by the opening of the different valves. The mechanism is simple and is not liable to get out of order like those instruments in which valves are put into or out of commission, and a new set of valves is used.

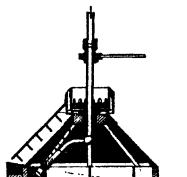
WOOD WIND INSTRUMENT.—N. ALBERTI, 2227 Hisell St., Chicago, Ill. This invention provides means for tuning wind instruments, such as flutes, clarinets, and the like. There is in use what is known as "concert pitch" and "international pitch." Many times musicians are obliged to make use of both, or are



WOOD WIND INSTRUMENT.

compelled to transpose the music, which is difficult; or some have instruments of different pitch which necessitates carrying an extra instrument. Moreover, instruments such as flutes or clarinets are often used with pianos whose pitch varies from true to international pitch. The purpose here is to provide a device which may be quickly tuned to any pitch.

SCREEN.—E. A. WOOD, P. O. Box 90, Glenn, Idaho. An object of the invention is to provide a device by means of which fine ores may be treated preparatory to concentration in a manner which effectually and economically prepares the ores for their subsequent treatment.



ORE SCREEN.

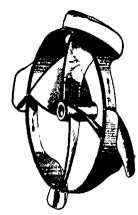
The invention provides a device which may be used in lieu of a hydraulic classifier in which the separation of the ore constituents may be made at a more rapid rate than with the ordinary hydraulic classifier.

CONDENSER FOR ZINC VAPORS.—M. APPEL, Johnstown, Pa. This device is designed to be used preferably with an electric furnace for condensing the zinc vapors which are driven off by the furnace. The condensation takes place through the medium of air or gas-cooled tubes in which the flow of air or gas can be easily regulated.

AUTOMATIC MULTIPLE NOTE HORN.—E. TASTE, 18 Rue des Bois, Paris, France. The air distributer is provided with several series of openings capable of being brought opposite the trumpets and so arranged that the sounds successively emitted will produce a complete musical phrase or a number of them. The operation of the air distributer is by a spring-pressed pawl jointed to a metal collar adapted to rotate on the distributer when the bulb is compressed and to act on a ratchet-wheel keyed to the distributer at the time the air enters the bulb. Means provide for arresting the air distributer. The construction permits of either entirely stopping the emission of sound or of producing a uniform sound.

ENVELOP.—C. G. GLOVER, 101 Laurel St., Watertown, Mass. This inventor provides a mailing envelop with an extending flap for the stamp, the blanks from which the envelops are manufactured being of such a shape that they may be cut economically from a sheet of material. The envelop, as stated, is constructed with a flap on which the stamps may be affixed in such a manner as to facilitate the cancellation of the stamps.

PROPELLER.—J. F. WOODYARD, 1221 Murdock Street, Parkersburg, W. Va. The invention provides an improved propeller adapted for use in water or air as well as in windmills and electric fans. The propeller consists of a hub and a band with four blades running from the hub to the band, two of the blades, as shown in the illustration, being broader than the other two, and hence acting as main

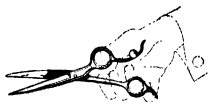


PROPELLER.

blades. The design of the blades is such as to give a straight line running quartering from the cutting edge of the blades, while the band holds the water, making it take the grade, thus causing a better end thrust and less slip than is ordinarily experienced. On the opposite side of the bands are buckets which operate to catch more water from the outside as the wheel revolves, thus giving greater power or end thrust to the wheel.

Hardware and Tools.

BARBER'S SHEARS.—W. H. TORNER, Factoryville, Pa. The main object of the improvement is the provision of a pair of shears, the use of which will obviate the painful fatigue to certain muscles of the hand and wrist which would occur when the ordinary barbers'

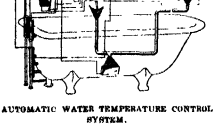


BARBER'S SHEARS.

shears are used. In using the ordinary type of shears the wrist is generally twisted so that the extensor ossis metacarpi pollicis, extensor pollicis, and extensor longus pollicis muscles are often affected. The invention remedies this by allowing the hand and wrist to rest in a perfectly natural position.

Household Utilities.

AUTOMATIC WATER TEMPERATURE CONTROL SYSTEM.—F. R. GERHARDT, Moosey, N. Y. This improvement relates to means for controlling a flow of water into bath tubs,

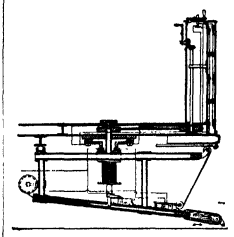


AUTOMATIC WATER TEMPERATURE CONTROL SYSTEM.

wash basins and other receptacles, and has particular reference to means associated with hot and cold water supply pipes whereby an operator at any desired position, either adjacent to the receptacle or remote therefrom, may, by simple adjustment of an indicator and the pressing of a button or the like, initiate the automatic control and flow of the water at any desired temperature.

Railways and Their Accessories.

AUTOMATIC CAR FENDER AND SAFETY BRAKE.—B. PERUCCASSE, address N. Twiorne, Ridgewood, N. J. This invention relates to an automatic fender for electric cars or other fast-moving vehicles, parts of which are adapted to be automatically extended by the

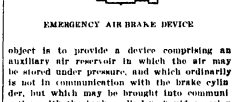


AUTOMATIC CAR FENDER AND SAFETY BRAKE.

impact of the body of the person in the way, so as to readily pick up said person with the least possible injury, and at the same time, to automatically set the brakes of the car so as to bring it to a stop in the shortest possible lapse of time.

CROSS TIE.—G. F. BROCKWAY, R. F. D. 4, Box 76, Edwin, Iowa. This improvement relates to railroad ties, and more particularly to a tie designed to embody all of the good points of the ties now in use with the added security of greater strength, rigidity, and structural changes to obviate rail spreading and tie bunching.

EMERGENCY AIR BRAKE DEVICE.—J. H. MACLEARY, 405 Bayard Ave., Wilmington, Del. An object of this inventor is to provide a device by means of which a street car or the like may be controlled even if an accident should happen to the main reservoir or the line leading therefrom, or even to the pump which supplies the main reservoir. A further



EMERGENCY AIR BRAKE DEVICE.

object is to provide a device comprising an auxiliary air reservoir in which the air may be stored under pressure, and which ordinarily is not in communication with the brake cylinder, but which may be brought into communication with the brake cylinder should occasion arise.

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SCIENCE

The Cause of Low Ocean Rail Rates

(Concluded from page 116.)

the shipper and the vessel owner, and in abolishing this burden the canal will confer a benefit that will be widely felt.

Appreciating its great commercial value, as many business men must have done, it is rather incomprehensible that the cutting of the Cape Cod Canal should have been delayed so many years, and the only explanation seems to be that those who investigated the matter in recent years were probably too strongly impressed and frightened by the ancient reports of engineers who based their opinions on primitive methods that have been entirely superseded by modern machinery and extended experience in later undertakings. It is, therefore, greatly to the credit of the intelligence and enterprise of the individuals who have successfully carried to a conclusion this much discussed project, and thanks are due them for a public improvement of widespread value.

The Unloading of Coal

(Concluded from page 117.)

In providing a means for the return of the empty cars. They do not necessarily come back on the same track. Here we have gravitation helping in the operation of the pier. This idea of a gentle grade is applied in several different ways in accordance with the surrounding conditions. In some cases, it has seemed necessary or advisable to employ a steep grade in connection with a gentle one. The explanation of this is to be found in part in the necessity to get the cars ultimately to a high level above the water. That is to say, the tracks at the point of discharge should be from 33 to 43 feet above the level of the highest hatches of the vessels at mean tide. As gravitation is to do the work of carrying the coal from the bins to the ship, there must be sufficient drop to enable this to be done, and at the same time accomplish a horizontal reach. The steep grade may, if it is not too steep, be overcome by the use of ordinary locomotives. In other cases, where space does not permit a long approach, the grade may have to be so steep as to require the use of a cable and barney.

Some of the piers are very long. The very longest are in New York harbor. Thus at South Amboy, N. J., the Pennsylvania Railroad has a pier 1,800 feet long. The same railway has one at Harsimus Cove, N. J., which is 1,750 feet in length. The Central Railway of New Jersey has two piers 1,600 and 1,700 feet in length, respectively, at Port Liberty, N. J., which may be used from both sides. But none of these piers have any very especial capacity, despite their great length, except that at Harsimus Cove, which is capable of discharging 300 cars per day of ten hours.

One object in view in introducing special machinery into plants which deliver coal to vessels is to save space. That is the reason cars are mechanically pushed up steep inclines instead of gentle ones. The plants which depend most upon mechanical arrangements are all located in the ports of New York and Philadelphia, where the price of land is presumably at the highest level. The Pennsylvania Railroad has two such installations at South Amboy, N. J., in New York harbor and one at Greenwich in Philadelphia harbor. Apart from minor differences, all these are operated upon the following plan. The car loaded with coal is received by a cableway, which takes it up a short steep incline to a "cradle." This is a movable framework, big and strong enough to receive and hold fast the car and its load. The cradle and car are then lifted and overturned sideways with the result that the load is spilled into a large apron. The carload of coal, say forty tons, runs or flows down the face of the apron into a chute, to the mouth of which the sides of the apron converge. Once in the chute, the coal is guided to the point in the hold at which it is desired finally to dump it. From the moment the car is overturned, the coal flows under the influence of gravitation alone. The apron may be raised and lowered, and the chute may be de-

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speed in a variety of ways. The empty car returns to the yards by gravity. Power is employed in this plant (1) to get the loaded car up the steep incline into the cradle; (2) to lift the cradle and car vertically; and (3) to overturn the whole. The car is taken up the incline and the vertical lift is made in order to get a sufficient elevation above the vessel to enable gravitation to complete the work. The Baltimore and Ohio Railroad has a plant of this kind at St. George, Staten Island, and the Delaware, Lackawanna, and Western Railroad has two at Hoboken, N. J., all three in New York harbor. The latter railroad has another mechanical plant at Hoboken in which the coal when dumped is received by a hopper. An endless chain conveyor takes the coal from the hopper and elevates it to a considerable height, from which it flows down into elevated bins. From the bins it flows down through chutes, finding its way at last into the hold of the vessel.

In a number of cases on the Atlantic coast, the plants delivering coal to vessels consist of a combination of the pier and mechanical appliances. Of the four new plants now under construction, two belong to this combination variety, and one to the excessively mechanical type. So that the trend seems in the direction of mechanical methods. In Norfolk harbor, that is, at Lamberts Point and at Newport News, two of the biggest plants are being constructed for the Norfolk and Western Railroad and the Chesapeake and Ohio Railroad. The piers in both cases will have a length of 1,200 feet. They will be operable from both sides. The height above the water in both cases is something over 91 feet. The daily capacity of either will be 600 cars of bituminous coal. Either pier will be equipped with more than 60 chutes. When they are completed, Norfolk harbor will have a total daily capacity of 3,180 cars, making it the second greatest coal harbor on the coast. These plants will operate by means of a car dumper, an elevator, and an incline for the return of empties. The railway car with its load will first be run up a short incline into the cradle of a dumper. The contents will then be dumped into a special dock car. This car will be carried up the elevator to the deck of the dock. It will then move out on the dock by gravity or under its own individual power to the point where it discharges its load into the pockets and chutes of the pier. When empty, the dock car will be returned down a steep incline under the control of its brakes. These two plants will be the leaders of all those operating on the Atlantic seaboard.

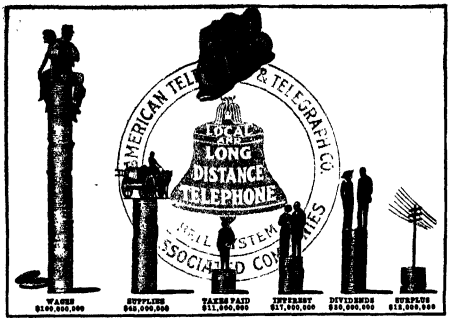
German Artillery in the War

(Concluded from page 116.)

while that on either side is an air reservoir. The recoil brake differs from the type adopted in connection with field guns. The gun is not connected to the brake cylinders, but to the piston rod. Consequently, it is the piston rod and the piston which move in the recoil of the gun, the brake cylinder remaining stationary. The air reservoirs consist essentially of an air cylinder, a ram with piston rod and piston, and valves.

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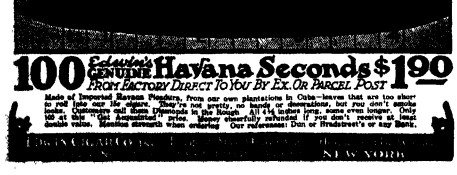
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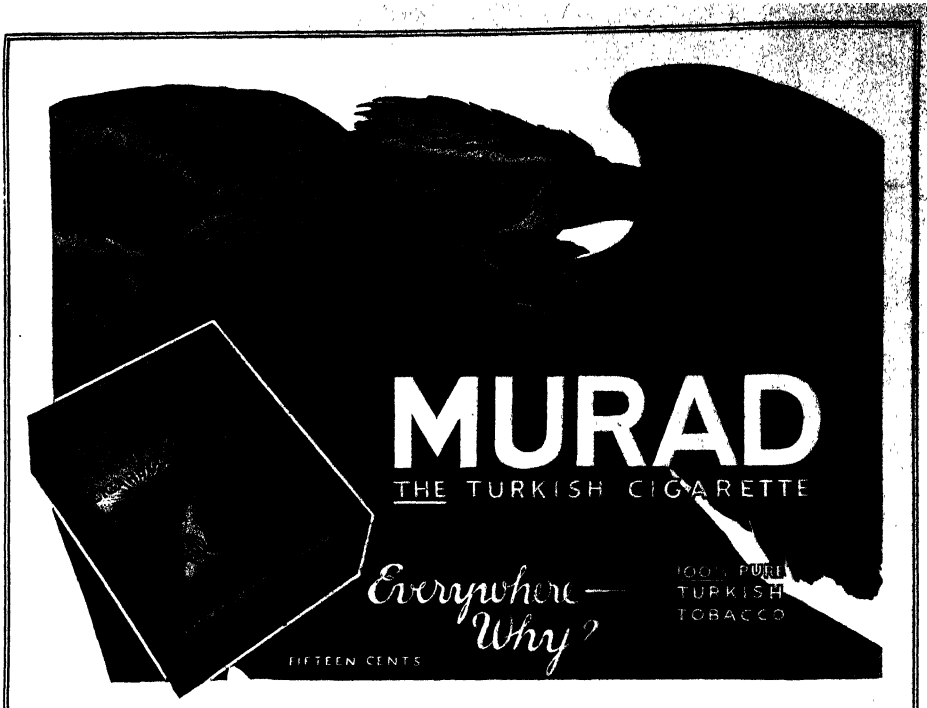
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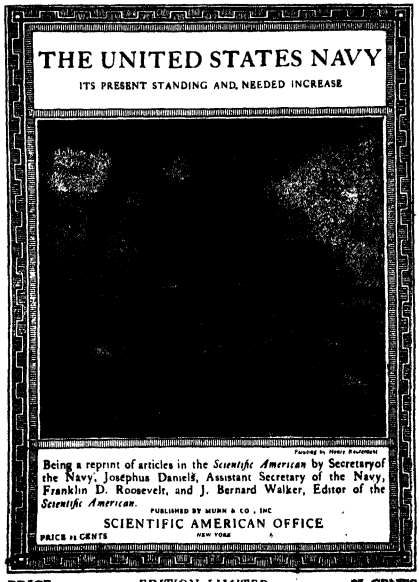
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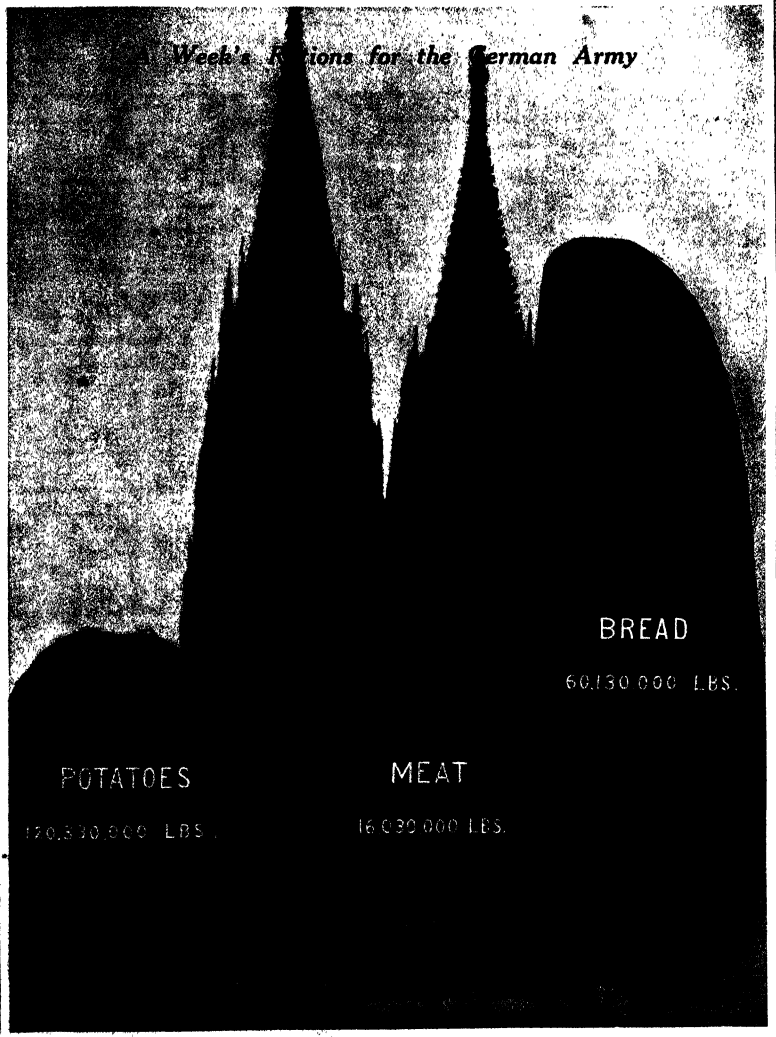
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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Notice

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The Indomitable Engineer

THE fascinating side of civil engineering lies in the mastery of unexpected difficulties. Practically every task presents its emergencies that call for ingenuity on the part of the man in charge; and it is these problems that relieve the drudgery of infinite detail and inspire the engineer with the joys of conquest. Instances of resourcefulness are to be found all around us, if only we take the trouble to look for them, particularly in New York, the city of great enterprises.

The enormous arch bridge now building across the East River at Hell Gate furnishes us with a good illustration of a unique problem and a unique solution. Work on the great viaduct that is to provide direct rail connection between New England and the South has progressed far enough to give us some conception of its finished appearance. The gaunt concrete legs of the viaduct are already a conspicuous landmark. One of the towers of the great bridge has been carried to the point where it must wait until the steel work is erected. This enormous steel arch, the largest in the world, will have a span of 1,017 feet. Were it built in the heart of New York city, we should find that it would stretch over four city blocks between towers, and the top of the arch would rise nearly as high as the Flatiron Building. The trusses, measuring 140 feet at the towers and tapering to 40 feet at the crown of the arch, will be built up of enormous members, some of them weighing twice as much as the heaviest members in any bridge heretofore constructed. Near the tower the bottom chords will have a section roughly of 7 by 10½ feet. Were it not for webs and braces, it would be possible to drive a load of hay through them. As may be imagined, the thrust of such an enormous steel arch will be something unprecedented. Each truss will exert a pressure of 30,000,000 pounds upon the foundations at the skew-back.

Here are conditions never before met with in bridge construction, but as if this in itself were not enough, a serious problem was encountered in the foundation of the tower on the Ward's Island side. Hell Gate, long a menace to navigation and still a difficult channel to negotiate, owing to conflicting tides, was known to be underlain with rock that is uptilted in a manner that might prove troublesome. Furthermore, the gas tunnel running across the river to Astoria had encountered a deep fissure in the rock, with a trend in the general direction of the proposed bridge foundation. Fearing that this fault might be encountered, extensive borings were made, but no break in the bed rock was disclosed. As the rock lay at a considerable depth and was very irregular in profile, it was deemed expedient to sink the foundation in separate caissons, using two rows of rectangular caissons, keyed together, to take the direct thrust of the trusses, with rows of cylindrical caissons between and on either side of the rectangular ones, connecting all at the top by a huge slab of concrete. Much to the consternation of the engineer, however, one of the cylindrical caissons failed to touch rock, even when carried far below the estimated depth, showing that the fissure did extend into the foundation site, after all. As the other caissons were carried down, it soon became evident that the cleft in the rock extended diagonally across the foundation. This provided a very puzzling problem. Any weakening of the foundation for such a record-breaking arch would be dangerous. If only the foundation site had been chosen a few feet to one side or the other, the fault could have been avoided; but a change in the line at this time could not be considered.

However, the solution of the difficulty was as simple as the problem seemed insurmountable. The resourceful engineer failed to see why he should not bridge the underground chasm, as he would one at the surface. Accordingly, he boldly threw a concrete arch across the fissure where it passed through the center of one of his rectangular caissons, and at another point where it cut across at the joint between two of the caissons, he bridged the gap by means of a concrete cantilever. The cylindrical caissons that encountered the fissure were carried to a considerable depth and flared to give them a broad footing.

The idea of building concrete bridges in a caisson is something absolutely novel in bridge engineering. Fortunately, the material covering the rock was clay, and hence it was not necessary to take such great precautions against the entrance of water. Otherwise the construction might have been far more difficult. The foundation has now been carried successfully to completion and forms a monument to the resource and indomitable ingenuity of the engineer.

Best Light for the Eyes

SOME three years ago the American Medical Association appointed a special committee to make a study of the effect of different lighting systems on the eye. The problem of lighting, as treated by engineers, has been for the most part an attempt to discover the most efficient forms of lighting from the point of view of economy—that is, how to get the most illumination for the least expenditure of energy. The problem of this committee has been to discover the form, distribution, intensity, and quality of light from the point of view of the health of human eyes.

The work of this committee is not yet completed, but preliminary announcements of results are of considerable interest. Among the aspects of lighting that have definite relations to the eye are: (1) evenness of illumination; (2) the angle at which the light falls on the object viewed; (3) the diffuseness of the light; (4) the evenness of surface brightness; (5) the intensity of the illumination; and (6) the quality of the light. The first four of these factors have been found by means of experimentation to be closely connected, although not absolutely uniform in their variation. Together they constitute what the experts call the *distribution* of the light. The ideal condition of distribution is to have the illumination as uniform as possible over the field of vision, with no extremes of surface brightness.

Daylight has been found to be the most satisfactory form of illumination, from the point of view of distribution. Daylight is pretty well diffused by numerous reflections before it reaches the windows. Inside the room, the window or skylight has a comparatively large area of relatively low brilliancy. These two factors contribute to a nearly uniform illumination of diffused light, with absence of extreme surface brightness.

Of the systems of artificial illumination, the so-called indirect is the best. In this system, the source of light is concealed from the eyes, the light being reflected to the ceilings or walls, and from these to the working surface. In direct illumination there is always the danger of having extremely bright spots in the illuminated surface. A system called the "semi-indirect" was found to be little better for the eye than the direct system. In this the light is thrown to the ceiling or walls, as in the indirect system; but part of the light is allowed to come through translucent shades.

The relation of the different systems of lighting to the diminishing efficiency of the eyes was brought out in a series of experiments in which daylight was shown to be almost without effect upon the eyes after three or four hours of work; under direct artificial illumination the eye loses working power at a very rapid rate, and almost as rapidly with the semi-indirect illumination. The indirect illumination was found nearly as harmless as the daylight. Sharpness of vision was also found to be highest, for any given degree of illumination, under daylight, and poorest under direct artificial lighting.

The deteriorating effect of the light upon the efficiency of the eye seems to be due to the fatigue of the muscles, rather than to any action upon the retina. Both the muscles of accommodation and of fixation seem to be affected. The explanation of the fatiguing effect of direct illumination is given by Dr. C. E. Ferree as follows:

1. The images of the bright spots near the margin of the retina arouse a reflex tendency to fixate on them instead of on the objects held in the center of attention; 2, the bright spots in the field of vision, but not in focus, arouse an unconscious reflex tendency to focus on them, so that there is constant variation in the accommodation of the eyes; 3, the bright spots fall on portions of the retina that are not adapted to them, cause discomfort and lead to asymmetric contractions of the muscles, which distort the clearness of the image and add greatly to the fatigue. The result of these factors working together is excessive eye strain, which shows itself in a loss of power in the work.

This explains why work in daylight, under proper distribution of windows, and with sufficient intensity of illumination, is not so tiring as artificial illumination.

Of course this is not the only element that concerns the health of the eyes. The intensity and the quality of the light are also of great importance.

For daylight and the indirect system, a wide range of illumination allows the eye to continue at work for several hours without undue strain, or rather without considerable falling off in efficiency. But with the semi-indirect and the direct system, there is evidence of fatigue at every intensity of illumination. In the semi-indirect, however, the eye can continue at work comfortably at an illumination represented by something more than two candle-power at the distance of a foot from the working surface. When the intensity is considerably more or less than this, even the semi-indirect illumination soon tires the eye. As most artificial lighting systems give a much greater intensity than this, the semi-indirect systems are as injurious to the eyes as the direct systems.

However, the safe intensity of illumination for the semi-indirect system is far too low for clear vision in most kinds of work. It is, therefore, impossible to get high acuity and low loss of efficiency with any system of artificial lighting except the indirect, although the semi-indirect will suffice at the safe intensity for most home work and office work.

Can Ultra-violet Light Produce New Species?

THAT ultra-violet light is able to produce new species of microbes is the startling announcement made by Mme. Victor Henri, whose work together with M. Henri in this field is already well known, having been carried out at the Paris University laboratories. Like all specimens, microbes are divided into well-defined, recognisable species, and it was observed that such species reproduced in like fashion to produce similar specimens, with the exception of some slight variations such as give rise to attenuated types, these latter being used for vaccination. But here we have no longer to do with a simple variation, but with a veritable mutation, that is, the formation of a new species which does not return to the ancestral type. The author operates upon bacteria which produce the disease common to animals, known as *charbon*, and according to a paper read before the Academy of Sciences, she exposes the bacteria for a certain length of time to the mitigated action of a quartz mercury vapor lamp which furnishes the ultra-violet rays. Under these conditions, the microbes are not all killed, as they would be by strong rays, but all are observed to be affected by the rays. Among the new types which are formed in this way by the action of the light, there is one, termed the *gamma* form, which is seen to be especially stable. For three months the daily cultivation upon gelatine always produces the same type, and it is concluded that this is really a new species.

Searchlights for Aeronauts

GERMANY will no doubt possess a very extensive system of high power signal lights for aeronautic use, and already there are some large-sized searchlights mounted in various places. We mentioned the electric searchlight at the Weimar aviation grounds, of which each flash gives 27,000,000 candle-power. For the use of aviators at a great height there is provided a large light on the top of the Taunus Mountain, at an altitude of 3,000 feet. At present, incandescent lamps give some 500,000 candle-power, but it is intended to use arc light so as to increase this to 50,000,000 candle-power. The revolving light on the top of the wireless mast at the Nauen air station gives four-minute flashes of 300,000 candle-power, using an arc lamp for the purpose. We also note the Bernstein revolving flash, which has 150,000 candle-power. On the Doeberitz military aviation grounds is an acetylene light of 27,000 candle-power, which gives three-minute flashes, while at Kadits, near Dresden, there is installed an eclipse lamp of 250,000 candle-power, in order to show landing places for aircraft. It gives two flashes in nine seconds. Illuminated numbers of large size are coming into use to show the aircraft headquarters to pilots, and among these is the Johannisthal grounds, which has a number lighted by lamps to the amount of 30,000 candle-power. But larger ones of 85,000 candle-power are mounted at Bonn and at Wiesbaden. Other high power lights are installed at Königsberg, Metz, Strasburg, and Trier and similar lights on the Rauen and Belgard, on the wireless telegraph masts.

Engineering

Dry Dock at Nagasaki.—Among the many improvements being made at the Mitsu Bishi Dockyard and Engine Works, at Nagasaki, is dredging out an immense basin to a depth of thirty feet to care for the largest ships building and increasing the size of its drydock. The length of the dock will be 734 feet and its width 100 feet, which will care for the largest battleship now building.

Irrigation In New South Wales.—The New South Wales Government is investigating an irrigation scheme which will back up the waters of the Clarence and Macleay rivers for a distance of 80 miles. Being close to the junction of the two rivers and having precipitous banks on both sides, the site for the dam at Grafton is considered ideal. Part of the plan is to give Grafton, 40 miles below, a supplementary water supply. Ample power is looked for, for all purposes, the Clarence being rated as the finest river in Australia. The work will cost several million dollars.

The Kaiser Wilhelm Canal Locks the Largest.—The original Kaiser Wilhelm Canal was begun only 27 years ago and was finished 19 years ago; nevertheless, although it was considered to have been built large enough to accommodate the ships of the future for a long period of years, it soon was found that it must be greatly enlarged to keep pace with the increase in the size of the ships, particularly those of the navy. The locks of the old canal are 150 meters long, 23 meters broad and 9 meters deep. The new locks are 330 meters long, 45 meters broad, and 14 meters deep. They will have a water content of 310,000 cubic meters, against a content of 124,511 cubic meters for the Panama locks. The latter are 308 meters in length.

Rail Anti-Creepers.—One of the most troublesome difficulties experienced in the maintenance of railway tracks is the tendency of the rails to creep in one direction. Creeping is due to wave action induced in the rail by the passage of the heavily loaded wheels. It is much worse on tracks in which the travel is all in one direction, the creep of course being in the direction of the traffic. Much attention is being directed to-day to the arresting of this movement, and several forms of very efficient anti-creepers are upon the market. They consist, usually, of an inexpensive form of clip with end jaws which engage the base of the rail, the clips projecting below the base and fetching up against the adjoining ties, thereby locking the rail to the roadbed against any longitudinal movement.

Wireless Station in the Society Islands.—It is hoped that the war will not interfere with the erection of that most important wireless station at Papatee in the Society Islands, work on which was to have been started forthwith by an arrangement between the French Government, its colony, and a French company. The station was to have cost about $200,000 and to have been powerful enough to communicate with New Caledonia, and perhaps with the United States. The station was a part of the work of making Papatee a port of call, in connection with which was the construction of lighthouses on five of the islands; widening, deepening and buoying the pass; repairing and enlarging the existing quays; building a new slip and providing the necessary working plant, tools, etc.

Opening of the Cape Cod Canal.—The opening of the Cape Cod Canal enables all vessels as far south as Charleston, S. C., to save 70 miles of distance going to and from Boston. Translated into other terms, this means that the average delay per round trip yearly for barges and schooners on the outside route is nearly four days, which is equivalent to a pecuniary loss of 10 cents per ton on the 7,000,000 tons of coal, and on the large amount of lumber carried by these craft. The total amount of coal and lumber carried by steamers is 4,500,000 tons annually, and the same amount per ton will be saved by these boats in using the canal. The tolls range from $3.00, for motorboats and other small craft, to $700 for trading vessels of 950 to 999 gross tons. Merchant ships of over 1,000 gross tons will pay 10 cents per gross ton for each passage.

Foreign Profits on the Sea.—Our contemporary, the *Marine Journal*, draws attention to the fact that a dividend of 10 per cent has been declared by the Nippon Yusen Kaisha (Japan Mail Steamship Company), which owns 85 steamships of 368,000 tons; all of which are employed in the sea commerce of the empire. The company is generously subsidized by the government, and the service is efficient and successful. Attention is also drawn to the fact that the amount of subsidies to steamship companies paid by the various maritime governments is steadily increasing, until it has now reached about $60,000,000 a year. Contemporaneously with this declaration of large dividends by the Japanese steamship lines, the firm of John Brown & Co., ship-builders of Clydebank, Britain, has declared a dividend of 10 per cent, as compared with 7½ per cent for each of the five years preceding. What are we going to do for our languishing marine in this country?

Aeronautics

Folding Aeroplane Wings.—In a patent, No. 1,104,347, for the invention of Horace Corbin, of Cleveland, Ohio, the wings are allowed to swing upward upon the operation of a simple mechanical release so that in case of accident the plane will readily and easily alight on the ground.

An Automatically Adjustable Plane.—In a patent, No. 1,102,790, George L. Oliver of La Grand, Ore., seeks to secure an automatic adjustment in a flying machine of the plane in accordance with the weight of the machine so the plane will be disposed in line with the center of gravity.

New Types of Arched Planes.—Joseph Bonnot, Alfred Belot, Jean Vassallo and Rose Emery, of Marseilles, France, have secured patent No. 1,104,242, for an aeroplane whose bearing surfaces are composed of arched planes, in which the greatest force of resistance is presented in front.

Pegoud's Latest Performances.—Our Paris aeronautic correspondent, Mr. John Jay Ide, informs us that on July 5th he went out to Buc to see Pegoud give the programme which he will present on his forthcoming tour in America. Pegoud's "dead leaf" upside down descent was thrilling, "but," says Mr. Ide, "the climax was reached when he got out of his seat and stood first on one wing and then on the other, holding on to the 'cabane' with one hand and waving to the crowd with the other, while the machine kept on an undulating course. He did this repeatedly, causing tremendous excitement. And the Blériot was not provided with a Sperry stabilizer."

Vertical Air Currents and Aviation.—In a recent letter to *Nature*, some interesting experiences of M. McLean are described. During his flight up the Nile, he found that the vertical air currents were frequently very marked. When the wind was only slightly different in direction from the line of the river there was a down current on the side from which the wind came, and an up current on the other side. When, however, the river split up into several channels the air was generally descending over the whole neighborhood and was disturbed. These down currents were, at times, so strong that his aeroplane when climbing at its greatest speed would descend steadily at 3 feet per second. He estimates that the maximum rate of climbing of his machine in still air was 4 feet per second. This observation is of great interest, as showing that a down current may exist of about the velocity of 4.8 miles per hour.

Carrier Pigeons on Aeroplane.—Carrier pigeons were let loose from an aeroplane at Buc not long since, and it was found that this could be done with very good success. The society, known as Colombophile Federation, wished to make trials of what could be done with pigeons when set loose at high altitudes, for it expected to be called upon to furnish pigeons for aeroplanes and airships. Trials were accordingly made in connection with the Blériot establishment at Buc. A basket with the pigeons was stowed in a passenger's place on board a tandem Blériot, and when at 4,500 feet altitude the pilot set the machine to volplane slightly and opened the basket, whereupon the pigeons flew out at once and took the direction of home, which lay at Agen. They were freed about 10 o'clock, and at 6 o'clock the first two pigeons arrived at Agen, after making the trip in 8 hours. It was considered that the trial succeeded very well, and further ones will be made before long.

Resistance of Struts.—It has been found possible, at the National Physical Laboratory, to reduce the travel of the center of pressure on the wings, which is the cause of all instability, to a material extent, and the interesting announcement, in the annual report of the laboratory, is made that in the near future it will in all likelihood be possible to maintain the center of pressure perfectly stationary by slightly uplifting the trailing edge in a reverse curve. The expedient has often been suggested before; to some extent it is even already incorporated in various types of aeroplanes, such as the Handley-Page and several German machines, but its effectiveness has hitherto been purely conjectural. The interplane struts on a biplane primarily, of course, are intended to form an integral part of the structure, serving simply to connect the two superposed planes. But they can also be made to serve a subsidiary function, for their collective side area may be employed to act as a fin, which usually consists of a vertical surface placed somewhere in the region of the tail, and forms an important element of lateral stability. Efficiency requires that the head resistance of these struts shall be diminished to the lowest possible point, and for this reason their shape approaches as nearly as possible to a perfect stream-line, as determined by laboratory experiments. To what a low point their resistance may be reduced will be evident from the fact that in a well-designed biplane it should not exceed 15 pounds and may well be even less. From the point of view of head resistance, the fineness ratio—that is, the relation of the length to the breadth—of a strut should be in the region of three; but if the struts are also designed to act as fins, the fineness ratio should not be less than 5 to 1.

Automobile

Carbon in the Modern Motor.—Recently some tests of the carbonaceous deposit which invariably collects after a time in all internal combustion motors, revealed that a considerable portion of the material was carbon, as was to be expected. Much of the deposit was composed of silicon and iron oxide. The presence of the silicon is ascribed to the road dust inhaled by the motor, and the rust to the water in the air and to detrition.

Germany's Motor Population.—According to official statistics, Germany now has 60,876 motorcars, 22,457 motorcycles, 9,739 motor wagons of commercial type, and 100 motorcycle carts. The latter are motorcycles with goods transportation bodies. These figures are for January 1st, 1914. The increases since January 1st, 1913, are, respectively: 21,116, 2,132 and 2,035 for the first three classifications; motorcycle carts, so called, decreased by 23.

Car Orders as Prizes.—During the latter part of August, an endurance contest will be held in Russia by the Grand Army of the Empire. It is to be known as the Coupe de l'Empereur and is offered for the purpose of ascertaining the type of motor car most suitable for use under Russian road conditions. The first prize will be an order for 250 cars, the second an order for 150 cars, the third an order for 100 cars, and the fourth an order for 50 cars.

Lubrication of Leaf Springs.—That the ordinary type of leaf motor car springs requires lubrication between the leaves at length appears to have been appreciated. Already a number of devices calculated to provide the lubrication have been placed upon the market. The latest device of the kind consists of a tiny metallic box which clamps to the outside of the leaves and which serves as a receptacle for oil.

An Electric Lighting Fault.—Electric lighting systems as a general rule have the fairly common fault that they project the light in two pencil-like beams which move with practically every motion of the car body, in other words, the diffusion is not great enough. What is desired is not so much great projection as more uniform diffusion which will more nearly approximate daylight. Another difficulty of the pencil-like projection is that it tends to magnify the size of small humps and bumps in the road. It would seem that some modification of the usual form of parabolic reflector is desirable.

A New Application of the Maxim Silencer.—A correspondent suggests that some one might devise a closed tank silencer fashioned after or following the principles availed of in the Maxim silencer for firearms. While automobile engines have been employed for various purposes entirely apart from the propulsion of the car, he does not recall any attempt to utilize the automobile engine in raising or lowering the top of the car. We hear of one man tops and other improvements, and it seems that in some way the engine might be adapted to furnish the power for adjusting the top.

Are Motor Car Hoods Necessary?—Now that the magneto has been made waterproof, and other parts of the modern motor car engine are so thoroughly protected from dirt and moisture, the question naturally arises, "Are engine hoods really necessary?" Why is it not possible to produce an engine so thoroughly enclosed that the ordinary sheet iron covering can be dispensed with? This should not be difficult, for already the valve mechanism is hidden behind metal plates; also, in a number of cases, the carburetor is all but enclosed. It should not be difficult to provide a carburetor intake which will permit of sufficient inspiration yet exclude such foreign matter as dirt and water.

Motor Testing by Vision.—There has been placed upon the market a new type of internal-combustion-engine testing device which makes use of a number of Geissler tubes. The tubes are contained in a small light-proof box, each being connected to one of the spark plugs of the motor. The discharge from the magneto, being high-tension current, causes the tubes to glow. The intensity of the glow will be affected by the condition of the magneto, and the degree of compression in the cylinders, which governs to a certain extent the ease with which the sparks will pass the spark gaps at the plugs. The failure of one tube to glow, obviously indicates that there is trouble in the corresponding spark plug, or magneto lead.

The Ideal Motor Car.—The question, "What is the ideal motor car?" is a moot one, and for this reason the discussion which revolved about it at the annual meeting of the Society of Automobile Engineers is enlightening. As a result of several sessions, it evolved that the ideal car in the opinion of the majority incorporates the following features: High-speed, high-efficiency motor with six cylinders measuring about 3 by 5 inches bore and stroke, respectively; streamline body; weight about 2,750 pounds with full equipment; electric lighting and engine starting system; dry plate clutch; four-speed gear set, worm drive; full-floating rear axle; cantilever springs, left side drive with center control, magneto ignition; pump circulated water cooling; double internal expanding brakes.



The diver getting into the suit.

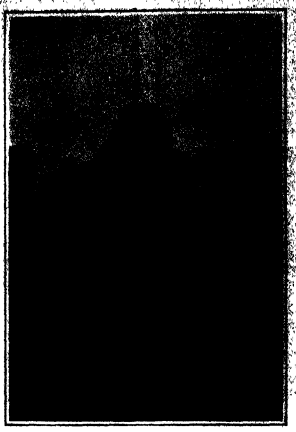


The twelve-fingered steel hand manipulated by the diver. It will pick a pin from the floor.

An All Metal Diving Suit

It Carries a Man Safely to Greater Depths Than Have Hitherto Been Attained by Divers

By Robert G. Skerrett



Attaching the arms to the suit.

DESPITE all the manifest dangers of diving, men have gone down to great depths and have performed labor there. In some cases the descents have carried them to submergences of from 160 to 180 feet, but their serviceable stays there have been very brief—a matter of a few minutes only at a time, and, in most of these instances, the underwater toiler has paid the price of his battle with nature's laws by sacrificing his health or materially shortening his days. The lure of treasure has inspired the venturings, and the price paid for the service seemed for the time to compensate.

The average diver seldom works in water more than 100 feet deep, and there are but few experienced men that can be counted upon to do good work at a depth of 150 feet. It is because of these human limitations that so many richly-laden wrecks lie undisturbed just beyond the reach of these toilers in the deep. Unquestionably, there are millions of dollars' worth of treasure trove awaiting recovery, and the tantalizing part of it all is that these richly burdened hulks are well known and reasonably well located.

The situation has been potentially altered here very recently by the experimental testing of a new form of diving dress, or armor. This all-metal dress was tried out in Long Island Sound, and twice in one afternoon, with the tide running strong, two divers were alternately sent to the bottom at a depth of 212 feet. Unquestionably this constitutes a world's record; but the performances were otherwise of the utmost practical significance. Let us give you material for comparison.

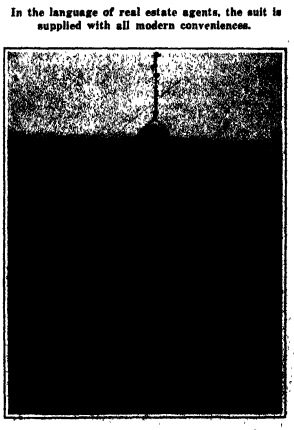
Several years ago, after a number of distressing accidents, the British Admiralty determined to make some scientific tests in the hope of eliminating certain dangers to which the naval divers were exposed in service. Without going into details, but by using double the number of air pumps and adopting several important precautionary measures, they did succeed in sending down two unusually fit men to a depth of 210 feet in the sheltered water of a land-locked bay. Now keep the next fact in mind. In descending, bottom was reached in two minutes, and, after a stay of 5¾ minutes, the men were slowly brought back to the surface—*the ascent taking 50 minutes!* This was required to insure safe decompression and to guard them against any ill effects of their great submergence.

In the all metal armor tested in Long Island Sound a couple of weeks ago, the men were lowered to the water-bed in a trifle over 3 minutes, being held when about a hundred feet down to see that the telephone was working properly. After being on the bottom for ten or more minutes, the divers were hoisted up and out upon the deck of the parent steamer in less than a minute and a half. Why was it possible to do this in the latter case and not with the British Admiralty divers? Simply because the American divers were not subjected to the hydrostatic pressure of the enveloping water, and were able to breathe air at atmospheric pressure. Their bodies were not subjected to abnormal stresses, and, therefore, no period of readjustment was necessary.

More than that, the air supplied them was abundant, their respiratory organs worked as they would at the sea's surface, and the ventilation of the suit was ample enough to carry off their exhalation and to prevent the accumulation of deleterious carbonic acid gas—the cause of so many accidents to divers in the ordinary dress. Again, working at the accustomed atmospheric pressure, there was not an excessive exhalation of carbon dioxide, nor none of the weakening conditions peculiar to labor in compressed air. Therefore, it would be possible for a diver in this new armor to work longer, to work harder, and accordingly to do more because of his physical security in the metal dress.



In the language of real estate agents, the suit is supplied with all modern conveniences.



Hoisting the diver out.

Briefly, this particular innovation in the art of subaqueous enterprise is the result of some years of gradual evolution, and is the invention of Chester E. Macduffee of New York city. The suit is made of an aluminium alloy of great strength, and even so weighs a matter of quite 480 pounds. The articulated sections are clever adaptations of the sleeve or rotating joint, and while suitably packed to reduce leakage to a reasonable minimum, still, thanks to roller bearings, give the diver ample freedom of action when the weight of the dress is taken up by the surrounding water. Indeed, a certain amount of leakage is desired, for it serves to lubricate the moving parts and, too, to keep the packing swelled, and, therefore, more efficient. But how is this leakage disposed of? This is one of the most admirable features of the armor.

In a recess back of the main body or trunk of the suit is installed a powerful little pump with suction intakes located in each foot of the dress. The discharge is immediately outboard and, of course, against the water head. The pump is driven by compressed air, this exhaust is delivered into the suit, and thus meets the breathing needs of the diver. The air is led down through a small tube, together with the electric light and telephone circuits, which, in turn, are carried in a 2½-inch armored rubber hose. The free space remaining in this big tube forms the channel back to the surface of the used air. The diver has no life-line to bother with, and his telephone permits him to keep in constant communication with his surface attendants. Should the telephone fail, the diver would be at once hauled up, but when working it makes it impossible to misunderstand signals or the submerged man's needs.

As a matter of contrast with the ordinary dress. When the second diver descended, he was held for some minutes at a depth of 100 feet. At that time the air compressor stopped, and it was not noticed by those in charge of him. Nevertheless, he hung there placidly unconscious of the breakdown, and was lowered to the bottom after the engine was going again. Had that happened to a diver in the usual form of dress there would have been a dead or dying man in the suit. There promises to be no difficulty in carrying on operations at depths of 300 and more feet. Of course the operator is entirely sheltered within his armored dress, and an ingenious mechanical hand is relied upon to grip and to make the necessary connections with suitable tackle or chain slings. The twelve fingers of this hand are able to pick up a match or a piece of paper laid flat.

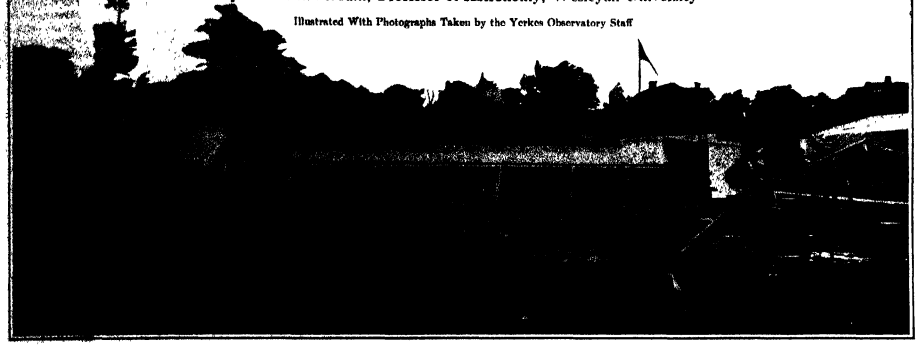
The Macduffee suit is a big stride forward in the art, and should prove of the utmost value in reaching sunken ships that now lie beyond human endurance when the diver is clothed in the best of the elastic suits at present employed. The grim ocean may be forced, in this way, to give up a goodly share of its ruthlessly gained wealth.

Gasoline and Burdock.—One of the readers of the SCIENTIFIC AMERICAN, Mr. D. T. Merrill of Battle Creek, Michigan, assures us that gasoline poured on the head or top of a burdock plant, will kill it, root and branch, and leave a hole in the ground.

This Month's Total Eclipse of the Sun

By Frederick Slocum, Professor of Astronomy, Wesleyan University

Illustrated With Photographs Taken by the Yerkes Observatory Staff



What an eclipse station looks like. This shows the equipment of the Yerkes observatory expedition at Wadesboro, N. C., May 28th, 1900.

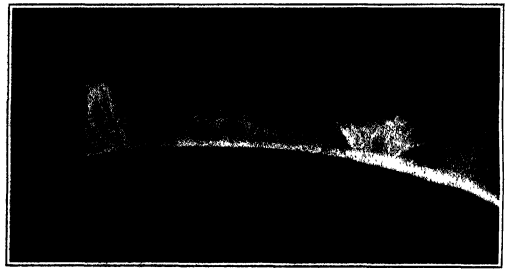
THINK of traveling thousands of miles just for the sake of observing the sun for two minutes! That is what scores of astronomers are doing this month. They are traveling at this particular time, because the sun will be totally eclipsed on August 21st, and many of them are obliged to go long distances, because the phenomena will be visible only along a narrow strip about a hundred miles wide, the part of which that is accessible to ordinary travel extending from northwestern Europe to southern Asia.

This narrow strip is in reality the path of the shadow cast by the moon as it passes between the earth and the sun. The shadow first strikes the earth, that is the total eclipse begins at sunrise, at a point in the Arctic Ocean, north of North America. It then passes northeasterly over northern Greenland, across the ocean north of Iceland, strikes the coast of Norway at Alstenö, thence passes southeasterly over Herrösand in Sweden, across Russia from Riga, past Minsk and Kiev, to the Crimea, across the Black Sea, over Trebizond in Asia Minor, thence across Persia, and finally ends at sunset in eastern India.

It may seem paradoxical to speak of "observing the sun," when the moon is so placed that it completely hides the sun, but, the fact is, it is not the brilliant disk of the sun itself, but rather the solar appendages and the regions around the sun that are studied during an eclipse, and many of these features can be studied at no other time. The reason for this is that our atmosphere diffuses and reflects sunlight, producing a brilliant glare, which blinds the eye to all relatively faint details.

On the moon, which is devoid of appreciable atmosphere, the shadows cast by mountains or by crater walls are intensely black, while on the earth so much light is diffused and reflected that one can see well, even within a house, as long as the sun is above the horizon. For an observer on the moon, it would be possible to hold a screen in front of the sun and cut off practically all illumination, but for an observer on the earth to use a screen effectively, it would have to be placed beyond the limits of the earth's atmosphere, perhaps several hundred miles above the surface of the earth. Such a screen is furnished by the moon on the comparatively rare occasions when it passes directly between the sun and the earth.

Under the most favorable conditions, a total eclipse of the sun may last about seven and one half minutes, but, in general, the duration of totality is much less.

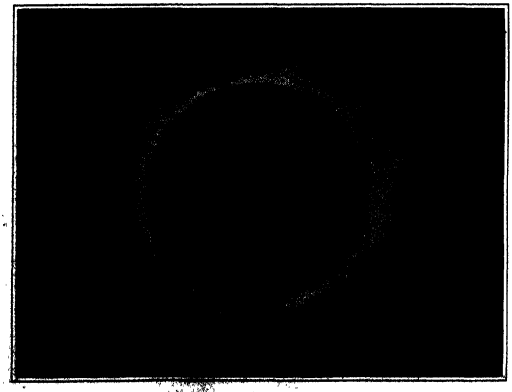


Solar prominences. These are tongues of gas that sometimes rise to a height of several hundred thousand miles.

The eclipse of August 21st will last a little over two minutes. The total time available for eclipse observations during the past one hundred years was a trifle over three hours.

Careful planning is, therefore, necessary to make the most of the few precious seconds available for observations, and stations are selected which give the greatest promise for clear skies at the time of the eclipse. In the case of the coming eclipse, the conditions for observations will probably be best in eastern or southern Russia, but observers will be stationed all along the line from Norway to India. Some of the expeditions have announced their prospective locations.

The Crocker eclipse expedition of the Lick observatory, under Prof. Campbell and Dr. H. D. Curtis, will be located near Brovary, about ten miles northeast of Kiev, and as near as possible on the central line of the eclipse. The Russian Imperial observatory at Pulkova will establish three stations, one on an island in the Baltic, one at Kanev, southeast of Kiev, and one at Feodosia in the Crimea. An expedition under the auspices of the Joint Permanent Eclipse Committee of the Royal Society and Royal Astronomical Society will be located at or near Kiev, the observers being Prof. Fowler, Father Cortie, Father O'Connor, and Major Hills. The Greenwich observatory will send a party under Messrs. Jones and Davidson to a point near Minsk. The Solar Physics observatory of Cambridge University, England, will be represented by Prof. Newall, Mr. Stratton, and Mr. Butler at Feodosia, and in the same locality will be an expedition under Prof. Perrine of the Argentine government observatory at Cordoba.



The solar corona, photographed by the Yerkes observatory eclipse expedition, at Wadesboro, N. C., May 28th, 1900.

The city of Hamburg is fitting out an expedition to be located at some point in eastern Russia. An expedition headed by Prof. Miethe of the Technological Institute of Charlottenburg, Germany, will go to the island of Alston on the Norwegian coast, where the path of totality first touches the European continent. Prof. Todd of the Amherst College observatory has announced his intention of trying to observe the eclipse from an aeroplane in the vicinity of Riga, Russia.

Each party will be equipped with telescopes, cameras, spectroscopes, polariscopes, etc. As the path of an eclipse rarely passes over an observatory, the problem of the transportation of instruments becomes an important one, and instruments intended for eclipse observations are designed with due consideration of the conditions to be encountered.

For example, astronomers going to Asia Minor or Persia are advised to pack their apparatus in pairs of boxes suitable for transportation on the backs of donkeys or camels.

Nearly all nations make special regulations in regard to customs examination and customs duties. The Russian Ministry of Finance has granted permission to import, free of duty, articles and instruments of a scientific character for the observation of the coming eclipse, provided that they are re-exported after the eclipse.

Large telescopes used for eclipse observations are generally mounted in a horizontal position, and the light of the object to be studied reflected into the lens by a system of mirrors. This obviates the necessity of transporting the long tubes and massive piers required in the usual equatorial type of mounting. Fig. 1 shows a group of instruments used by the Yerkes observatory eclipse expedition at Wadesboro, N. C., in 1900.

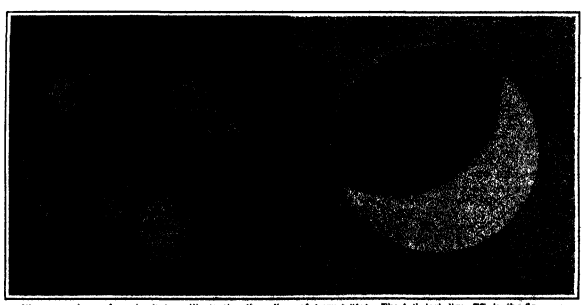
Formerly, eclipses were observed chiefly for the purpose of correcting the tables of solar and lunar positions and motions, but now the emphasis is laid upon the study of the sun as a star, and upon its radiations. Although merely one of the countless millions of stars in the universe, it is by far the most important from our point of view, and it is so much nearer to the earth than any other star that more detailed study is possible. Whatever we can learn in regard to the sun is just so much knowledge gained in regard to a large class of stars

The following will indicate the nature of some of the observations which astronomers and physicists will try to make on August 21st:

1. The determination of the times of contact of the disks of the sun and moon

2. Search for planets and comets by photographing the regions near the sun

3. Study of the solar coronal (*a*) Small scale photographs to trace the extension of the coronal streamers. (*b*) Large scale photographs for the inner details, and the study of the relation of the coronal arches to sunspots, prominences, and faculæ (*c*) Large scale photographs through "mercury green" glass to determine the distribution of coronium (*d*) Study of the spectrum of the corona for the more accurate determination of the wave-lengths of the coronal lines, and to investigate the rotation of the corona. (*e*) The polariscope will be used to determine 1, how far the polarized light of the equatorial streamers can be traced, 2, whether the polarization of the light in the polar streamers is radial or follows the curve of the streamers, 3, whether the polarization of the light from the blue sky changes during the eclipse. (*f*) The intensity of the radiation of the corona, and the quality of the coronal radiation as compared with that of the sun will be investigated



1Diagram, redrawn from *La Nature*, illustrating the eclipse of August 21st. The full dark line, FF, in the figure on the left, is the path of the total eclipse, and is really the path of the shadow cast by the moon as it passes between the earth and the sun. It is only one hundred miles wide, and at any one point in this path the total eclipse will last only a little over two minutes. The shaded portions of the illustration represent water, and the light colored parts land, so the course of the eclipse can be easily traced from the Arctic Ocean, north of North America, across Greenland, Norway, Sweden, Russia, Asia Minor, and Persia, and ending at sunset in eastern India. Outside the dark path of total eclipse, and within the region bordered by the dotted lines, only a partial eclipse will be seen, a condition illustrated in the drawing at the left, but in varying degrees, depending on the location.

The path of the solar eclipse plotted on the earth.

4 Large scale photographs of the solar prominences will be made especially for the purpose of comparing the features shown by composite light with those obtained by the spectrohelliograph using only the light of calcium or hydrogen.

5 Spectra of the chromosphere and of the reversing layer will be obtained in order to investigate the depth of the various known gases, and to search for new gases

6 An extensive series of observations will be made with wireless telegraphic apparatus to investigate the effect of the passing of the shadow upon the strength and nature of arbitrary signals and stray currents.

Observations with wireless apparatus and photographs of prominences with the spectrohelliograph will be made in various places for comparison with results obtained during totality, but, aside from these two lines of research, there will be little interest in the eclipse outside of the line of totality

In the northeastern part of the United States it can be seen as a partial eclipse just after sunrise. In New York the partial eclipse will last from 5 hours 35 minutes to 6 hours 9 minutes A. M., and in Boston from 5 hours 41 minutes to 6 hours 39 minutes A. M.

The next total eclipse of the sun visible in the United States will occur on June 8th, 1918. The path of the shadow will cross the Gulf of Mexico, the central part of the United States, and western Canada.

Curious Things About Handwriting

By Dr. Leonard Keene Hirshberg, A.B., M.A., M.D. (Johns Hopkins)

"'TIS hard to say, if greater want of skill appears in writing or in judging ill," quoth the poet. Sound judgment is the ground of writing well, and when philosophy directs your choice, to proper subjects rightly understood, words then will naturally flow from the pen.

"Men write with ease to show their breeding,
But easy writing's cursed hard reading."

The incurable itch to scribble is a natural impulse to the human hand. The inveterate use, however, of the pen rarely changes or improves the scrawl. In sooth, the shape, form, and character of the words and letters are but slightly the outcome of the muscular movements.

For the most part, writing is the upshot of inheritance, childhood discipline, habits of character, temperament, disposition, and what may well be called your chronic mood. Mr. R. H. Chandler has recently devoted great care to the study and investigation of likenesses which exist in the writing of various members of the same family.

So strong is this similarity in some families that it is often difficult for the expert to distinguish one member's hand from another's. Indeed, the same word written by different persons, seems to be written many times by one.

Likeness in handwriting follows the same general principle, according to this investigator, as that which acts in families, as regards resemblances in face, motions, and that family likeness among human beings, which may be defined as an accumulation of indescribably faint suggestions of similiarity rather than any strong identity; for instance, a family likeness may show itself by the color of the eyes, shape of the nose, general outline of face, or eccentricity of manner, but more often it is the *tout ensemble*, something that cannot be put into words and defined accurately, which causes old friends of parents to exclaim, "Isn't he like his father!" or "He is just like his father as a boy." This brings us to another point of agreement between handwriting and ourselves, likeness at corresponding ages. It would be absurd to expect a grandfather of seventy to write like his son of forty-five or his grandson of twenty, but there may be just comparison between the grandfather's writing of middle age and his son's at the present time, or between that of the son and the grandson at corresponding ages. Another point of agreement is what may be called "peculiarities," and the father who has a style of handwriting which shows these peculiarities will frequently bequeath them, more or less unaltered, to his son. Bearing in mind these suggestions, that is, the influence of age on handwriting and the meaning of the expression "family likeness," Mr. Chandler has been unable to collect such striking specimens of the handwriting of women as of men, and it may probably be taken as a general rule that women do not write such characteristic "hands" as men. The vast majority write very much less than men. Besides, most girls on leaving school write a better handwriting than boys at a corresponding age, which does not change so very much through life, whereas a boy usually does not begin his characteristics and permanent handwriting until some years after he has left school. There is a common style of girl's handwriting known as the high school writing. It shows [illegible] more characteristically than men. [illegible] a man whose handwriting may [illegible] sixteen and thirty. These remarks apply to [illegible] who write a few family letters, and not to a [illegible] woman who might write as strong or as [illegible] style of handwriting as any man. That handwriting is an acquired character there can be hardly any doubt. You only inherit the power of learning to write, but it would appear that the members of a family inherit the power of writing in a particular way. There are, nevertheless, the questions of influence and imitation to be considered.

Charles Darwin long ago recognized that handwriting was inherited, and this idea may be found running through scientific literature as an axiom for the past fifty years; but, so far as Mr. Chandler knows, it has not been illustrated before.

The juniors in an office came to write much like their chief as time went on, showing that handwriting is imitative, sometimes to a remarkable extent. In some instances environment has very little to do with it, but in many cases there is so little to know of the influences brought to bear upon such an elastic growth as handwriting, that it is quite possible to underestimate the effects of environment.

Strange Animal Tragedies

THAT almost unerring instinct which carries animals through grave dangers, has led in many instances in the Midway and Sunset oil fields of California to their undoing. Chief among such victims are rabbits and waterfowl.

A jackrabbit and a cottontail find a nice round, smooth hole. There are many such in the oil fields where oil piping is a necessity for the transportation of oil to the refineries. The rabbits decide to set up housekeeping there. The cottontail desires a permanent home, and the jackrabbit wants a refuge safe from malevolent man.

Soon they discover their habitat is being moved. No doubt they are frightened, but they instinctively stay within their retreat. One end of the hole is closed. Even then they do not leave. Soon the other end of the hole is darkened. Then it is darkness eternal for the furry pair.

Some time later it is discovered that a newly laid oil pipe line is choked. After great labor the line is disjointed and the remains of many rabbits removed. Thousands of rabbits have been thus exterminated in the oil fields.

The death rate among waterfowl is even greater. Again, as with the rabbits, instinct leads them to certain destruction. Every little lake of oil in the vicinity of a gusher is a trap for the unthinking birds. At twilight and dawn these tar-colored lakes appear as bodies of water to the deluded fowl.

Great flocks of migratory waterfowl have been seen to drop out of the heavens after sailing majestically above the barren, sun parched desert and plunge into these oil lakes. Pelicans, snow geese, and ducks of all varieties that fly annually between Alaska and the flats of the Colorado River, swoop down to the oily bosom of these lakes. The moment feathers touch oil, their flying days are over. Helplessly the birds struggle to rise out of the gummy mass. Some remain helpless floating on the reeking surface, and are soon overcome by the fumes of gas rising from the oil. Others dive the moment after alighting, as most swimming birds do instinctively when frightened. Strange as it may seem, the sight of fowl struggling in the oil, and of thousands of blackened bodies floating on the surface, apparently fails to deter others from the plunge.

Frost Injury to Plants.—The mechanism of freezing in plant tissues is still a somewhat obscure subject. An interesting contribution to this subject is made by W. Russell, in the *Comptes Rendus*. He finds that the death of a plant through frost does not take place suddenly, but rather cell by cell, and is retarded proportionately to the amount of undamaged tissue. Thus a specimen of *Sonchus oleraceus* destroyed by frost at the end of December, still contained living cells on February 9th in the thick lignified cork ring at the base of the hollow stem, which had been completely disorganized.

The Prospects of Aerial Fighting in the Present War

What May be Expected of Dirigibles and Aeroplanes

By Carl Dienstbach

Whatever is the news that comes from Europe must be, there is no excuse for scientific [illegible] the most interesting of technical questions suggested by the present war—the military [illegible] highly developed air fleets of the powers [illegible]

[illegible] equipment offers the least puzzling problem. [illegible] contemplated before any French dirigible was [illegible] one half as large as the standard [illegible] If any of those planned and reported [illegible] should put in an appearance at the eleventh hour, there would be no question but the lack of any experience in handling units so vastly exceeding in size any familiar standard might prove disastrous under the rough conditions of war. The disaster that befell the British "Mayfly" proved that conclusively.

There is little secrecy about military aeroplaning except as to the number and organization of flyers, which is much known in the case of Germany. Little difficulty has been opposed to studying every detail of French and German army aeroplanes. But of the largest type of lighter dirigibles, which doubtless are in a class by themselves, very little is known.

The New Zeppelins and the Old.

Barring the latest passenger airship "Sachsen," and the military one that got into temporary control of the French authorities after the famous landing at Luneville, none of the newer Zeppelins has been publicly pictured or described. A foreign traveler who recently attempted to snapshot the "Z I" after it had been damaged in a stormy landing had his camera promptly confiscated. In spite of the secrecy maintained, a close observer can glean not a few important data on the capacity of the newest rigid airships, so far the only representatives of the largest and most potent size of dirigibles, by piecing together odds and ends of news. The most advanced craft—the new naval airship "L III"—has the enormous displacement of 32,000 cubic meters. After a trip of thirty-five hours, at an average speed of 62 miles an hour, it had enough fuel left over for sixteen hours more. That trip touched Basel, Frankfurt, Metz, Bingen, Bremen, Heligoland, Stettin, the Baltic, Potsdam, and Berlin, but not over the shortest distance. Between Metz and Bingen, flying with the wind, a speed of 94 miles an hour was realized. The wireless equipment covered a range, both in sending and receiving, of 460 miles, and kept in communication with Friedrichshafen, on Lake Constance, while flying over Heligoland. "L III" mounts an electric searchlight of 40,000 candle-power, capable of brightly illuminating the ground from an altitude of 4,500 feet, to be used intermittently, especially in casting bombs. Similar searchlights are carried by all German airships.

The second dirigible built for the navy is the wooden "S L II," the second improved vessel of this type. With its new framing, it looks much like a Zeppelin. The hull, however, is more spindle-shaped. Four cars carrying motors of 180 horse-power each are loosely suspended, and one propeller, mounted on the propeller shaft, is directly placed behind each car. There is a navigating car in front and platforms for artillery on both sides, in the center. The "S L II" displaces 23,000 cubic meters and supports a useful load of over eight tons, but it can, nevertheless, reach an altitude of 7,500 feet. The speed is well over fifty miles an hour.

Bomb-dropping Practice With Zeppelins.

In addition to these two naval airships, there are completed eight military Zeppelins; the older ones recently lengthened to increase their capacity, the newer of very considerable size. It goes without saying that the three passenger ships of the "Delag" are by now converted into armed warcraft identical with the rest, and that in the dockyards at Friedrichshafen and Potsdam work is going on night and day on reserve ships. This gives a fleet, barring the "Z I," under repairs, of just twelve rigid, monster dirigibles, to which the enemy can oppose nothing adequate. Successful target practice with machine guns and cannon and in dropping great weights of explosives has been long conducted on these vessels, as well as in the accurate dropping of tons of the highest explosives. The only [illegible] to be learned is dodging the enemy's fire. That only the experience of actual war can teach. For this reason it seems unlikely that the aerial dreadnoughts will engage at the outset in an aggressive rôle, which would be so much more dangerous than long-range scouting. The potentialities of a skillful use of their [illegible] powers go [illegible] that a commander [illegible] unnecessarily hesitate to risk their loss by trying to do too much before experience has become adequate.

Scouting flights, on the other hand, can be made in such secrecy, especially at night, that doubtless many of them could never be reported. Traveling leisurely over great distances, these dirigibles, in enabling the German commander to know exactly how the enemy's mobilization was progressing, would enable him to play a game successfully, which to the uninitiated might appear unreasonable and daring.

Where the French Air Fleet Stands.

The French air fleet's time seems, on the contrary, not yet to have come. Their slow dirigibles would risk much more in starting out on long trips over an enemy's country, not only from attack, but from the craft's own limitations. For very extended aeroplane trips, with only hostile soil below, even the French flyers do not seem to have so far shown great inclination.

Attacking aeroplanes run infinitely less risk than bomb-dropping dirigibles, yet with all the numberless flock of French machines available, one solitary instance of dropping a bomb, near Nuremberg, has been reported. If news about the activities of French flyers is credible, it reads as though they had been governed largely by their individual feeling as to risks to be taken. The attempt at Nuremberg, of destroying a railway far inland where trains are easily switched to another route, seems useless, yet would be less risky than attacking more important and more closely guarded junctions. The ease of bringing every rifle within several square miles to bear on the same aeroplane might account for the alleged shooting down of a French flyer over the fortress of Wesel. It seems especially surprising that not more has been heard of attempts to destroy the all-important dirigible sheds. The news might be suppressed in Germany, but if such plans had succeeded the news would surely have come from French sources. As each shed is surrounded by an aerodrome, it is easily guarded by aeroplane patrols. The great plant in Friedrichshafen is fortunate in being close to the lake, and a great hydroplane factory, that of Dornier, is being protected by the monster aerodrome "Johannisthal." That dazzling searchlights (blinding an aviator so that he cannot determine the location of the shaded shed) and special artillery will not be lacking seems a foregone conclusion. One might also expect an encampment of infantry, supplemented by machine rifles, to fringe the grounds on all sides, ready to concentrate fire on anything above at a moment's notice.

Protecting German Airship Harbors.

American travelers have reported the mounting of machine guns on the Cathedral of Cologne and on the roof of an hotel in Cologne, but little suspected their true purpose of protecting one of the principal airship sheds of Germany. The French may now regret having neglected the Germans' systematic development of night flying. The stories of the whole night sky between Paris and the Eastern frontier blazing with searchlights read picturesquely enough, but if one remembers that all the searchlights of the fortress of Toul failed to pick up a French dirigible whose time of coming had been announced, they lose significance, if the aircraft's aim is merely unobserved passage. Nothing is seen at a distance and dodged so easily as the long, pale shaft of a searchlight. If target practice against the ground with cannon should be equally far developed as against aerial foes, to plant a shell from afar out of the dark at some point guarded by a searchlight, without the risk of being detected—which in dropping bombs would be very real—seems perfectly feasible, but hardly worth trying, when victory itself depends on gathering information without the enemy's suspecting it. At war altitudes, Zeppelins are now perfectly silent. With their great internal resources they may now be hovering, nightly, over the enemy's country for whole nights, reporting observations by their long-range wireless, as unseen as the English cruisers now off New York. Little of the "L III's" 35-hour trip could be traced from the testimony of observers on the ground, although most of it was made in daylight and there was no attempt at concealment. Great damage could doubtlessly be done by bomb dropping, but the possible usefulness would hardly justify the risk of being set upon by flocks of aeroplanes. A Zeppelin is too hard to replace, compared to an aeroplane, to risk it in an air battle as long as it can influence the issue far more by silent, unsuspected scouting at long range. The chances for attack by Zeppelins will be much improved after the mass of French aeroplanes is established in the field with the army. French dirigibles hardly count, as they are quite as vulnerable, cannot mount real cannon on top of the gas bag, and are hopelessly outclassed in speed.

France has recently completed a squadron of armored aeroplanes, carrying great weight, but they are comparatively slow, and their armor offers no protection against the Zeppelins' shell fire. No doubt they will be needed for risky scouting at the front. It does not look as though this war, except for the Zeppelins, would be very different from the conflicts in Tripoli, the Balkans, and Mexico, except for its vastly larger scale. The many French and Russian dirigibles would not seem to count for much, because they are too slow, insufficiently armed, and therefore far less prepared to fight aeroplanes than the German dirigibles, while inferior radius of action and speed makes secret scouting also more difficult. They have not even claimed, so far, to have made good their former threat of destroying the Rhine bridges during mobilization. The most formidable dirigible so far constructed in France, a medium sized *Astra Torres*, is in English hands, and the English possess in their Parseval also the second fastest airship of the Triple Entente. The readiness of the German government in allowing the sale of that Parseval speaks volumes for the superiority of the larger type.

Russia's Aeronautic Inefficiency.

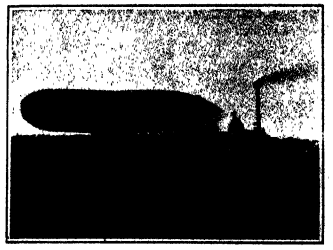
There is one more unknown factor—the Russian mammoth aeroplane. Its speed is little more than that of a Zeppelin; its radius of action with adequate load very much less, and its use over hostile country beset with the gravest risk, due to its dependence on good ground for starting and landing its ponderous bulk. It is also equipped with German motors, and new motors would seem hard to procure even from France under present conditions. The whole Russian aeroplane fleet was incomplete when the war broke out, arrangements having been made just previously to add more than two hundred. If Russia should be left for some time to its own mechanical resources, it would be worth while to know that, as a well informed Finlander told the writer a year ago, she boasted then of one automobile factory in the whole empire, whose sole customers were grand dukes and high officials.

The ordinary type of military aeroplane following the troops and operating right on the battle ground may be expected to be much in the foreground in a war that started at the present development of military aeronautics. Its rôle will not appear so spectacular since we had become used to it in previous wars. But, due to the immense number of such machines, we may not only expect frequent instances of inconclusive bomb dropping, but irregular, unsystematized fighting in the air with machine guns or rifles. All indications point to the fact that hostile aeroplanes can avoid clashing in the air at least as easily as cruisers at sea. Aerial tactics have hardly been perfected. Only if French or English aeroplanes went after Zeppelins, which received them with machine gun and artillery fire, and German or Austrian aeroplanes came to the rescue, would we be likely to see some lively fighting in the upper regions. The regular army machine gun, weighing some fifty pounds, has been known as a regular installation only on specially heavy French fighting aeroplanes, owing, no doubt, to the weight of ammunition required for sustained fire. But there are lighter types, and we may expect at least a rifle or automatic pistol on any air machine. The French have at least one specially large aeroplane mounting a light cannon. But it is a foregone conclusion that the ammunition supply of such a gun must be very limited if compared to that of a 30-ton Zeppelin, and close proximity of gun and motor with resulting vibration will make aeroplane fire much less certain than Zeppelin fire.

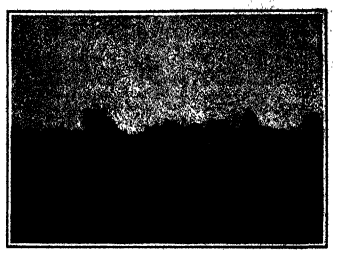
Theoretically, Zeppelins, by the efficiency and range of their fire, could be employed to keep away aeroplanes from positions which it would be imperative to conceal, better than other aeroplanes. But, owing to the immense number of French aeroplanes compared to the number of Zeppelins, this use could be resorted to only on very special occasions. It will hardly be expected as long as long-range scouting remains, a much more important task for Zeppelins.

As long as the new aerial equipment is still so very small compared to the old-fashioned fighting apparatus, scouting in the air still take precedence over fighting.

The Imports of Matches into China greatly exceed in value any other wood product. Most of the matches come in from Japan.



Charging a Parseval dirigible with gas.



A Russian supply train.



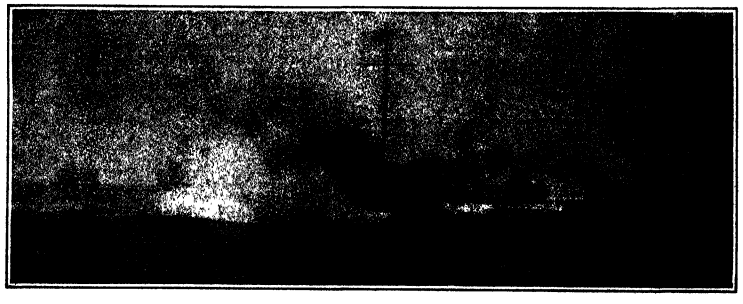
The Emperor of Germany reviewing the fleet.



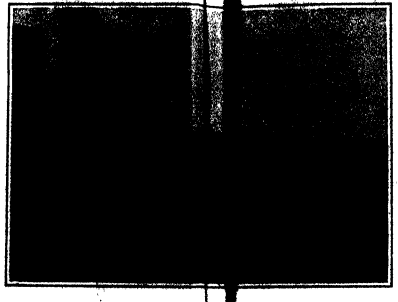
French infantry in the field.



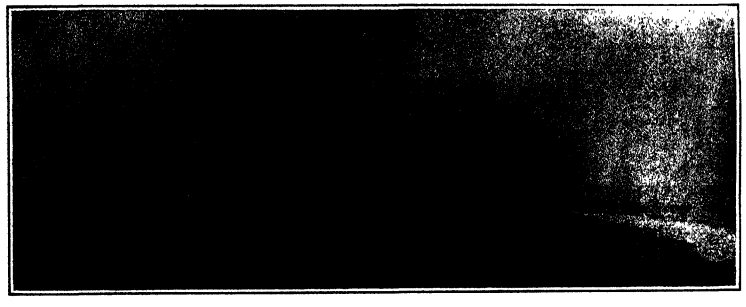
A Russian cavalryman in marching order.



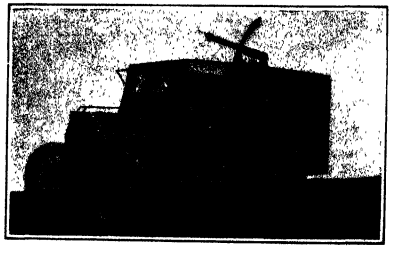
A group of British torpedo boats.



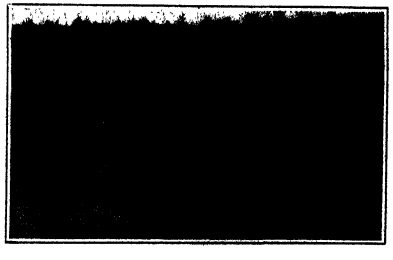
Conning tower and bridge of British battle-cruiser "Lion."



Division of German destroyers in maneuvers.



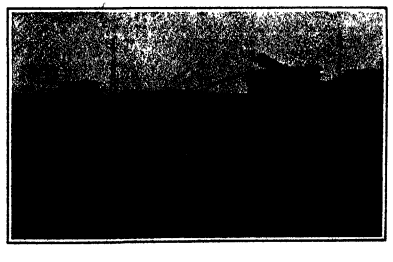
German armored automobile with machine gun.



German 7.5-centimeter aerial gun in transit.



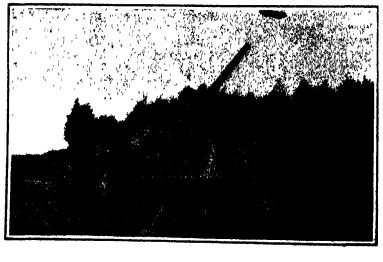
English field artillery [illegible] automobile.



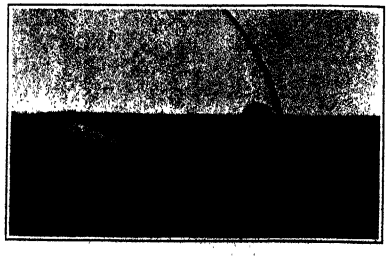
Hauling back a German 21-centimeter mortar for transport.



German 28-centimeter mortar in battery.



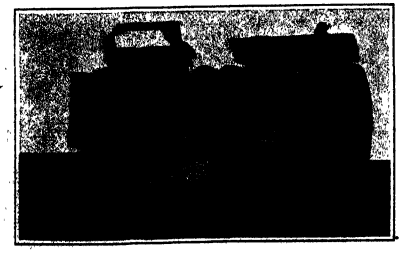
German 7.5-centimeter aerial gun in firing position on motor truck.



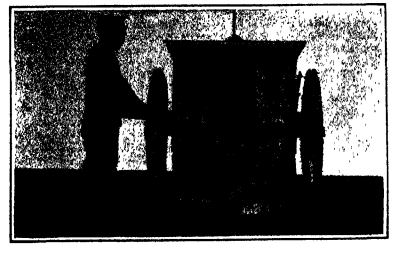
German 13-centimeter bomb-launching tube for airships.



Dreyse (German) [illegible] for firing at aircraft.



German 10.5-centimeter howitzer with ammunition cart.



German ammunition cart. Shells for 9.5-centimeter howitzer.

GLIMPSES OF THE EUROPEAN [illegible] MACHINERY NOW IN ACTION

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A Relief Map of the United States

To the Editor of the SCIENTIFIC AMERICAN:

A relief map of the United States, executed on a large scale and suitably housed, should prove most interesting and instructive to the public. A horizontal scale of 1 to 50,000 and a vertical scale of 1 to 400 would probably be suitable; but such details would have to be determined by experts. A special building would be required for the proper protection of the great map, and this should be provided with suitable galleries, and perhaps with a traveling crane.

The cost of the whole outfit might be as much as a million dollars. As the exhibit should be under the cognizance of the Weather Bureau or some other Government office, the necessary outlay should be borne by the national treasury. It follows that the best location for the structure would be at the national capital.

The structural problems involved would be, I think, not at all difficult. T. W. KINKAID.

Annapolis, Md.

The Fallacy of Eternal Youth

To the Editor of the SCIENTIFIC AMERICAN:

Being especially interested in the discussion of this subject as given by J. A. Guthrie in correspondence column of SCIENTIFIC AMERICAN of August 1st, 1914, the writer of this letter feels prompted to offer another link to the chain of argument presented in original letter under above caption.

The concession is being frankly made by the scientist that under the influence of a primitive system of hygiene and sanitation, all functions of the human body were maintained at such perfect balance as to establish an antediluvian longevity that placed the maximum limit of life close to the 1,000 years mark.

In such case natural death resulted not so much from the breaking down and disintegration of molecular cells, but rather from the gradual and mutual "slow-down" of the entire machinery of life, and at a time when there were few marks of decrepit old age, or the presence of organic disease upon the body to disturb or destroy its vital organism.

Like the apple that falls from the bough only as it attains to complete ripeness, so real old age and death come when the purpose of life in this world would have been fully met, as in the recorded instances of Moses, who stepped from the stage of human action at a time when his eye had not become dim or his natural force abated L. J. HEATNOLE.

Dale Enterprise, Va.

Neolithic Man in Arkansas

To the Editor of the SCIENTIFIC AMERICAN:

In Madison County, Arkansas, a railroad is being constructed from Combs, on the White River, about fifteen miles to Cass, Ark. In going this distance, this road passes over the ridge or rim of what is known as the Boston Mountain. The road passes through a low gap in the rim; just after passing this narrow ridge, there was not sufficient space on the ledge to construct the road, and blasting was resorted to, in order to furnish room on the right of way; and huge masses of sandstone were blown out of the side of the mountain.

A little later workmen were using these, breaking them up with heavy sledges and placing them as ballast on the track.

Last week two workmen broke open a large fragment with their hammers and it was found to contain a stone ax. The ax was well fashioned and showed that evidently it was the workmanship of Neolithic man; the ax was firmly and fully imbedded in the substance or matrix of the rock, and the rock furnished a good cast of the ax, where the ancient tool was loosened and taken out

Above the ledge from which this rock was blown there is fully seventy-five or one hundred feet of sedimentary longitudinal strata, known as the "Winslow formation." The ledge from which the ax was blown is evidently the lower stratum of the Winslow formation, or the upper sandstone stratas of the "Morrow formations." There was no evidence of any cave formation where the ax was found. The formation was solid strata

How long has this ax been there? Evidently it was dropped in water, at or near the shore of this ancient coast line of the Gulf of Mexico, when the great Boston Rim was a circular island, some sixty miles from rim to rim, and in the shape of a horseshoe, with the opening to the west. The substance into which this ax was dropped and into which it sank was the then soft beach sand on the shore of this island, which is but one of the archipelago of curious circular ridges that form what is known as the low range of the Boston Mountains. These confront the Gulf of Mexico.

Evidently after the ax was lost the archipelago sank, and remained there long enough for seventy-five or one hundred feet more of strata to be formed. And then the gulf receded away to the south.

How long has this been? On the summit and sides of the hills and to the north, in the central lagoon of this ancient island, are to be found many stone mortars and stone hoes, showing that there existed considerable population, and this ancient man was something of an agricultural being.

But the great question arising seems to be not the newspaper query, "How old is Ann?" but the more scientific paleontological inquiry, "How old is Neolithic Man?" DR. E. G. DAVIS.

Kansas City, Kan.

The Moon's Craters

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of April 4th, No. 14, I was very much interested in the article "Origin of Structures on the

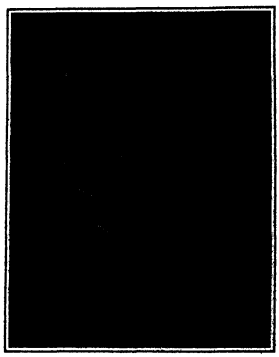


Fig. 1.—Scrap of iron exhibiting lunar structures.

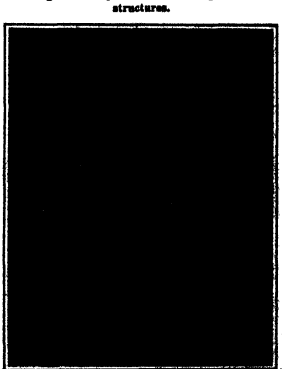


Fig. 2.—A possible explanation of the moon's craters.

Moon's Surface," as this topic has occupied my attention many times.

I beg permission to suggest the following explanation, according to my way of thinking: The moon, from whichever celestial body it came, is composed of almost pure iron like meteors and cosmic dust, and, having traversed a great extent of absolute vacuum, in a molten state, expanded into a huge porous or hollow sphere, comparable, in form, to a particle of cosmic dust which continually bombards our planet.

On examining a scrap-pile in an iron foundry, it is not uncommon to come across some pieces of iron exhibiting some of the structures seen on the moon (Fig. 1). The lunar structures are very different from one another and bear very little resemblance to our volcanic craters. Some are narrow and deep, while others are shallow and very wide; some present a central cone, while in others this feature is entirely absent.

Let us imagine a huge mass of [illegible] gas and steam pockets, buried [illegible] opened the spherical shape, the [illegible] in it expanded rapidly and [illegible] the surface like geysers, throwing [illegible] directions and producing a sort of [illegible] vibration at each vent that burst one [illegible] waves in the surrounding molten [illegible] caused the widening out of the craters into [illegible]

The bright patches called oceans are [illegible] of the metal which kept its metallic [illegible] the absence of atmosphere.

To reproduce these phenomena in the [illegible] a common rubber ball and perforate it [illegible] with a very fine, hot needle; this being [illegible] very soft plaster mixed with a little [illegible] molten metal containing gases, and [illegible] stream of air into it until the plaster is [illegible] notice the change that takes place on its [illegible] 2). My experiment as illustrated in the [illegible] very crude, as I have no means of doing it as I [illegible] to do; but, if I had taken a perfectly round [illegible] had given it a more even layer of plaster, the results might have been much better. I made the holes too big. That is the reason why they opened out so much. Anyhow, it gave me the very results I looked for. Somebody else might do better using the [illegible] disclosed.

Joinville, Brazil.

Subsistence in the Present War

THE question of subsistence is a vital one [illegible] army, and many battles have been lost [illegible] failure of food supplies. The commissary department of armies in all civilized countries is in the [illegible] men who are in reality dietetic specialists on a [illegible] scale. The present war is the supreme test for the quartermaster's department.

"Rations," as the daily food supply of the [illegible] is known, vary in each country according to [illegible] tastes or climatic conditions, thus, the meat ration of France is quite different from that of Germany. For the purpose of comparison we have taken the daily [illegible] ration of the German army, which is as follows:

750 grammes of fresh bread,
or 500 grammes of biscuit;
375 grammes of raw meat (fresh or salted),
or 200 grammes of smoked beef, pork, mutton, bacon, or meat sausage;
125 grammes of rice (groats),
or 250 grammes of pulse or flour,
or 1,500 grammes of potatoes;
25 grammes of salt;
25 grammes of coffee (roasted),
or 80 grammes of coffee (green),
or 3 grammes of tea and 17 grammes of sugar.

We have shown this supply for a week compared with the huge mass of Cologne Cathedral. The result is very surprising, for we have a loaf of bread weighing 60,130,000 pounds and 393 feet high, which bulks well alongside the lofty edifice. Meat is represented by a side of bacon, but in practice this might be varied by sausage, smoked beef, fresh beef, salt meat, or mutton. The bacon is 180 feet long and would weigh 16,080,000 pounds. Potatoes are the heaviest item, weighing 120,330,000 pounds, and the gigantic tuber shown in the engraving would be 188 feet high and of a proportionate girth. The bag would be two feet less in length, while the sugar bag would measure 38 feet high and would weigh 1,705,000 pounds. Such amounts of food seem almost incredible.

Of course, the figures given are for the standard ration, which is probably a very different thing from that actually being consumed along the great battle formation, for there is great flexibility as to the food to be used. It is possible that pemmican (a condensed meat product) has entered into the ration very largely, but we will not get much accurate information until the close of the war. The Kaiser has always expressed a lively interest in the soldiers' food, and he has not infrequently ridden up to the field bakeries and sampled the product of their ovens.

Some idea of the enormous expense of the war will be gained when it is stated that the daily cost of provisions for the combined armies would be $14,000,000 without the expense of transportation, which would be $4,300,000 more each day. These figures were based on a comparison of prices of some years ago so that 25 per cent could be added to the cost of the food, making the cost $18,750,000, or $22,300,000 "delivered" at the place of consumption. This is truly an enormous daily bill of the war butcher, war baker, and war grocer.

A Novel Shock Absorber is a patent, 1,104,690, to Peter K. Olechna of Schenectady, N. Y., is shown a shock absorber in the form of bearing spring supported frames to which the axles of the vehicles are connected in such manner as to cushion shocks both fore and aft.

Russia's Giant War Flyers

The Sikorsky Aeroplanes and How They Are Constructed

By Major H. Bannerman-Phillips, Aeronautical Correspondent of the Scientific American in England

The ideal mechanical flying machine, which relies for support in and progress through the air upon aerodynamic resistance alone, should be one that transports the greatest load in the shortest time for the least expenditure, but it goes without saying that this is unnecessarily the ideal for a specific purpose. For instance, in a machine built for military purposes, and more especially for scouting, speed is essential, other considerations being quite subordinate, though desirable. In discussing any type of aeroplane, therefore, and its main points of design and construction, we must first of all know the purpose for which it is designed. Is that purpose a definite one, and is it to be accomplished regardless of other considerations?

The Tendency to Specialize.

During the past twelve months or so the tendency for makers and designers to specialize in machines intended for specific purposes has been very noticeable, and it is well that it should be so. Although we may hope that in due time the aeroplane will be used for other than warlike or sporting purposes, it is evident unfortunately that at present it is only a hope, and when one takes up the discussion of large aeroplanes, such as the Sikorsky machines, it is mainly with a view to understand their suitability as war machines, for no heavier-than-air flying machine in the present state of development of the art of construction can be regarded seriously as an ordinary passenger carrier for the promotion of human intercourse, either from the point of view of economy or safety.

The Sikorsky a Warcraft.

With regard to the huge machines designed by Sikorsky, it is very certain that speed is not the main quality striven for, but steadiness, power in the form of airworthiness, and weight-carrying capacity, either in the shape of passengers, fuel, or gun and ammunition, bombs, searchlights, and wireless telegraphic apparatus. In discussing these machines it must be remembered that the whole of Russia is forbidden to foreign aircraft. As these notes are being written it is reported in the press that a German Zeppelin, which strayed across the frontier, was promptly fired upon by the frontier guards. Little information as a rule leaks out as regards progress in Russian naval or military aeronautics, and such items as appear in the press can only be taken as straws which may possibly serve to show which way the wind blows.

For Sea as Well as Land.

It is understood that not long ago five Sikorsky machines had been ordered for the Russian Admiralty to be fitted as sea planes, in addition to a number which had been ordered for the army, but whereas we in England have good cause to know by now from a tolerably wide experience, that a good aeroplane for land service requires something more than the addition of floats in order to convert it into a seaplane, there are no details to hand as to the proposed Sikorsky hydro-aeroplane.

Great Flights with New Motors.

On the other hand, it is stated in the technical papers that on the 25th of June, M. Sikorsky established a record by flying for 6 hours 33 minutes 10 seconds with six passengers *during the night*, and that during the same day, with ten passengers, he reached a height of 2,000 meters, or 6,560 feet, in 1 hour 26 minutes 21

(Continued on page 138)



The huge Sikorsky machine in flight.



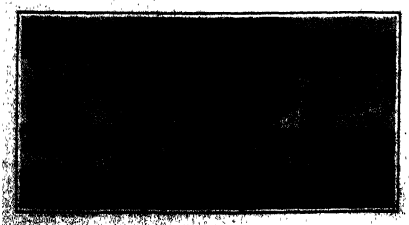
A glimpse of the interior arrangement.



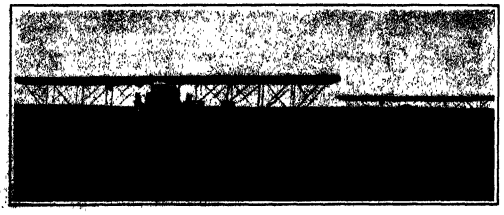
The Czar inspecting the Sikorsky machine.



The pilot house.



Russian dignitaries climbing into the machine.



The Sikorsky machine compared with a standard biplane.

John P. Holland

JOHN PHILIP HOLLAND, the inventor of the submarine boat, died at his home in Newark, N. J., on August 12th, in his seventy-second year, as the result of an attack of pneumonia, which seized him early in July.

Mr. Holland was born in Ireland, and at one time was a school teacher. His attention was directed to submarines by the news of the fight between the "Monitor" and the "Merrimac," which revolutionized navy construction, and it set him to thinking how it could be revolutionized again. The result was the conception of the submarine, which he developed and perfected only after years of study and experiment. In the year 1875, after fifteen years of serious work, Holland produced what he believed to be a practical vessel for underwater warfare, and submitted his designs to the United States Navy Department. The engineers who examined the plans are said to have reported that while the craft was practical, still its operation was so dangerous that no one could be found to undertake the work, and the plans were rejected.

Mr. Holland was described as a quiet, retiring man, but possessed of great determination and tenacity of purpose, and this is demonstrated by the fact that notwithstanding this rejection by the Government, and the many satirical and unfriendly comments by the public press, he persisted in his enterprise, and at once began to study how to overcome the objections of the Government experts, devoting eighteen years more to the task. In 1893 he submitted plans for an improved boat, which met with approval, and an appropriation was authorized for the construction of the new craft, but owing to disagreements with the naval engineers the plans were withdrawn, and Holland and his associates built an improved craft on their own account, which proved so successful that the Government bought it after a most satisfactory demonstration of its capabilities.

The Forfeiture of German Patents in England as a War Measure

ACCORDING to a newspaper dispatch printed in the Washington *Times*, W. L. Runciman announced in the House of Commons that the Board of Trade is now considering releasing, for the use of the British manufacturers, all patents owned by Germans that are registered in the United Kingdom.

If this measure is actually approved and enacted, which we can hardly believe possible, it goes without saying that Germany will retaliate. To be sure, the great German chemical manufacturers might lose much by having their English patents revoked. On the other hand, the damage which British inventors, particularly inventors of mechanical appliances, will sustain, will be equally great. It seems incredible that either nation would be so foolish as to destroy intellectual property in this way.

Manicuring a Lioness

THE wild animals in our menageries, cooped up as they usually are, in narrow cages, although intended by nature to live a free roaming existence, are very apt to have trouble with their feet. The nails do not wear off as fast as they grow, and they become uncomfortably long, making it necessary to pare them off from time to time. In some cases, trimming of the nails is necessary to lessen the danger of attacks by ferocious beasts upon the keepers. At any rate the services of a manicurist are frequently required in zoological parks. As may be imagined, the operation, particularly in the case of a lion or tiger, is most dangerous. The accompanying photograph shows "Trilby," a lioness at Lincoln Park, Chicago, undergoing this trying, but very necessary operation. "Trilby," it may be remembered, is the animal which recently killed her trainer, Emmerson Dietrich, in a box car. The man who is cutting her claws is Cy de Vry.

X-Raying an Elephant in Search of a Diamond Ring

TO find the location of a $450 diamond ring which she had accidentally swallowed, Minnie, a trained



X-raying an elephant in search of a diamond ring.

elephant, performing at a Cincinnati summer resort, was compelled to submit to being X-ray photographed.

The elephant was eating peanuts out of the hand of a man wearing the valuable ring, when playfully she slipped the saliva-covered end of her trunk over the



The Rocking Stone of Tindal.

fingers of the hand in search for more peanuts, and to the astonishment and consternation of the man, took the ring along in withdrawing it. Quickly she tossed it into her yawning mouth, heedless of the futile efforts of the owner to make her drop it.

To locate the ring X-ray photography was resorted to. Minnie's side was marked off into seven sections and seven X-ray plates were marked to correspond with the numbers painted on her side. One after another the photographs were made of her interior in an effort to find the exact location of the missing ring. It showed up in plate No. 1. The ring had become firmly lodged in the throat of the elephant, and she could not cough it up nor would it go down. A veterinary surgeon was summoned, and he probed the animal's throat for the ring. The valuable gem was soon recovered and the elephant was none the worse for her novel experience.

The Trade Routes

THE war in Europe has not only interrupted international trade, but it presents serious [illegible] which must be surmounted before a normal [illegible] of merchandise is possible along the old trade routes. With this abnormal condition great consumers of goods abroad, their European supplies having been cut off, are looking to the United States for merchandise.

The American manufacturer is not only prepared to meet these foreign demands, but he is confident that with the establishment of friendly trade relations, he will be able to compete with Europe and retain his new foreign customers after treaties of peace have been signed. This is indicated by the steps which are being taken to develop the new trade routes on a permanent basis, which is evidenced by the many trade-marks which are being registered abroad by citizens of the United States.

The Rocking Stone of Tindal

EVERYONE has heard of rocking-stones—masses of rock so delicately poised as to move backward and forward upon the slightest impulse. Until quite recently the giant among these curious phenomena was the famous Rocking Stone of Tindal, in South America, which fell, for what reason is unknown, a few months ago. Existing rocking stones were mere marbles compared to the Tindal. It weighed something like 700 tons, was composed of granite, paraboloid in shape, and measured some five meters in height. It was ingeniously poised upon a knob of rock in a low range of hills some 250 miles south of the city of Buenos Aires.

Under-water Weed Cutter

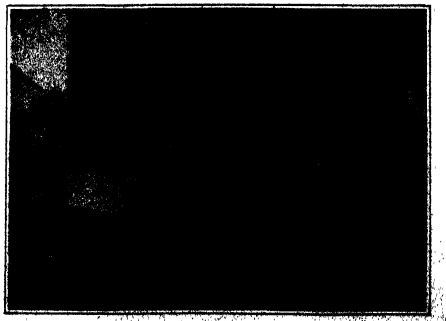
A NOVEL mowing machine has been built by a resident of Silver Lake, Wisconsin, for mowing down submerged growths in lakes and streams. The apparatus is mounted upon a flat bottomed boat, the lines of which are curved to insure easy running and steering. The boat is 15 feet long and 4½ feet wide with a paddle at the rear driven by a side shaft connected to the paddle wheel by bevel gearing. The side shaft is driven by sprocket chain connection with a gasoline engine. The side shaft extends to the front of the boat, carrying a pitman adapted to oscillate a sickle or cutter. The oscillating sickle moves in contact with a stationary one, which acts as a guard, but does not clog in the mossy weeds. The sickle is raised or lowered at will by a single operator. The lever for raising and lowering the sickle may be seen at the left in the photograph. Weeds may be cut in water as shallow as 10 inches and as deep as 4 feet, the swath being 10 feet wide. When cutting the boat makes a speed of 4 miles per hour.

Polishing Pearls

PEARL ornaments may be elegantly polished by first rubbing with olive oil to remove the dirty appearance, then applying any red nail polish. This latter gives a burnished appearance, and with a little fast rubbing the pearl takes on a brilliant glow.



Trimming "Trilby's" toe-nails.



Mower boat for cutting submerged weeds.

RECENTLY PATENTED INVENTIONS

Interesting patents are now being issued. All patents are secured by special arrangement with the inventors. Terms on application to the Advertising Department of the Scientific American.

Pertaining to Apparel.

GARMENT.—A. GOLDZIEG, 134 W. 26th St., New York, N. Y. This improvement refers particularly to a shirt having a placket opening, closing member for said opening, and fastening means for drawing the edges of said opening together to adjust the garment to the wearer and for securing the closing member over the placket opening.

Electrical Devices.

ELECTROLYTIC APPARATUS.—J. D. Pennell, Butte, Mont. This invention provides a novel electrolytic apparatus for the treatment especially copper ores in which the metal is deposited from a solution. The use of the apparatus results in a large economy of floor space, this being an important item in a large reduction plant.

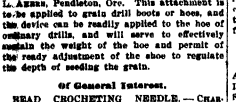
Of Interest to Farmers.

CULTIVATOR.—C. F. DAVIS, Arcanum Pass, Tenn. This combined harrow and cultivator is especially adapted for cultivating small plants, such as cotton, corn, and the like, wherein mechanism is provided for quickly adjusting the cultivating mechanism to the plants, whether the said plant is on a ridge or on the level or in the furrow.

ATTACHMENT FOR GRAIN DRILLS.—M. L. ARESS, Pendleton, Ore. This attachment is to be applied to grain drill boots or hoes, and the device can be readily applied to the hoe of ordinary drills, and will serve to effectively sustain the weight of the hoe and permit of the ready adjustment of the shoe to regulate the depth of seeding the grain.

Of General Interest.

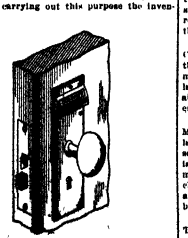
BEAD CROCHETING NEEDLE.—CHARLOTTE I. DENNEN, Route No. 2, Santa Rosa, Cal. In this invention the loop is strung with beads arranged as to color and number in reverse order to that in which they are to be used, both sides, if necessary, of the loop being



BEAD CROCHETING NEEDLE.

strung, and as the work progresses the beads are slipped down from time to time over the loop of thread on the hook, the needle being momentarily lifted from its saddle in order to let one or more, as required, of the beads slip down over the lower end of the needle

INDICATING DEVICE.—CARL G WEVAT, 1 Elizabeth St., Hardentown, N J This invention has particular application to a device for indicating the condition of a room, bath house, locker, or similar place so that a prospective occupant will be advised as to whether the locker, room, or bath house is occupied or open. In carrying out this purpose the inven-



INDICATING DEVICE.

tor provides a device which will be operated from the bolt of the door lock and which will be constructed in such manner that when the bolt is in locking position, a signal, indicating that the room is occupied, will be displayed, while when the bolt is retracted, the signal displayed will indicate that the room is open

Hardware and Tools.

EXPANSION NAIL.—G. C. RADDUE, Waterloo, N. Y. The object in this case is the provision of a new and improved expansion nail for use in concrete, fence posts and other structures, and arranged to permit of conveniently applying the expansion nail and to securely fasten a fence wire or other article in place.

PLIER.—G. T. STRICKLAND, (assignor to International Tinplate Co.), 411 N. Broadway, St. Louis, Mo. Among the objects of this invention are to produce a file particularly of the flat face surface type, adapted especially for the finishing of fine work, the teeth of the file being arranged and formed in a peculiar manner with respect to one another and the body of the file.

Heating and Lighting.

AUTOMATIC IGNITION SYSTEM FOR GAS LIGHTS.—J. W. LUNDAHL, Thomaston, and O. A. ERICSON, Litchfield, Conn. Address the former, Box 585, Thomaston, Conn This invention is especially adapted for use in connection with automobile lamps, whereby the driver can light the lamps by a single control without moving from the seat, and while useful in this connection, it is understood that it is applicable for house and other lighting systems where the burners are to be lighted from a remote point.

FURNACE DAMPER REGULATOR.—R. M HYDE, Westfield, N. Y. This invention automatically regulates the dampers of furnaces used in vapor or low-pressure steam heating systems. It provides means for regulating the dampers, said means comprising a device of the gasometer type with a device for preventing the forcing of the water in the gasometer out of the same by the steam pressure, and also for preventing the entrance of air into the gasometer when the steam pressure has been lowered.

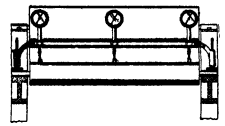
Household Utilities.

GAS BROILER.—G. W MURRAY, 210 N. Carolina Ave., Atlantic City, N J This broiler is more especially designed for broiling meats and other food products, and arranged to subject the meat to be broiled to the full upward force of the heat to insure proper broiling, to protect the gas jets from becoming clogged up by drippings from the meat during the broiling operation, and to shield the cook from the flare of the gas flames

Machines and Mechanical Devices.

ELEVATOR WELL DOOR OPERATOR AND LOCK.—P. G. WESTERBERG, care of St Luke's Hospital, Amsterdam Ave. and 113th St., New York, N Y The present invention relates to an improved device for holding the gate or door of an elevator well or the like positively locked when closed so as to prevent opening thereof except by the operator of the elevator, and also to permit opening and closing of the gate conveniently by the operator

PAPER MAKING MACHINE.—D. L. LESLIE and J. L. HARRIS, Box 51, Roanoke Rapids, N. C. This invention provides means for measuring or gaging the thickness of a sheet of paper just after it has been formed and when it is still in the wet state before being calendered. It provides a gage which may be



PAPER MAKING MACHINE.

turned so as to be readable from various parts of the room in which the machine is situated. It also provides means for indicating the thickness of the paper at any desired place. A special form of gage is provided which will register variations of 1-10,000 of an inch in the thickness of the paper

FEATHER FABRIC MACHINE.—J. A. COLBY, Seville, N Y. In the patent of the present patent the invention has reference to machines for manufacturing feather goods, and has particular reference to a machine for assembling suitable feathers in the form of bows, or for several purposes, such as for collars or trimmings.

SMOKE STACK CLEANER.—F. C. WILLAT, Montevideo, Uruguay, S A This invention relates to means for cleaning a smoke stack of soot and other adhering matter, and an object is to provide a readily actuated mechanism, by means of which the inside of the stack may be cleaned of the soot, and the top of the stack automatically closed in the act of starting the brushing mechanism

ATTACHMENT FOR FEEDING CARDS TO TYPE WRITERS.—I G HOLLIDAY, Boise, Idaho. Mr. Holliday's invention is an improvement for feeding cards to typewriters, wherein a magazine is provided for containing a packet of cards, envelopes, or like articles, as for instance, filing cards and mechanism in connection with the magazine for feeding the cards in succession to the typewriter. The engraving herewith gives a view of the improved feed shown in connection with the typewriter

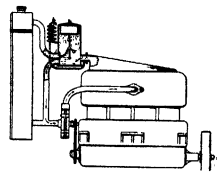


ATTACHMENT FOR FEEDING CARDS TO TYPEWRITERS.

MECHANICAL MOVEMENT.—C. W. GIFT, R. F. D. No 2, Box 24, Waynesboro, Pa. The invention provides a simple, inexpensive means for converting reciprocating movement into rotary movement The rotary member consists of a wheel with half of its circumference concentric and the other half having a depression with teeth at each side It rotates within a frame which constitutes the reciprocating member, the latter having an internal periphery patterned to mesh with the rotary member.

Prime Movers and Their Accessories.

AUTOMATIC RADIATING SYSTEM FOR INTERNAL COMBUSTION ENGINES.—E. A. SAYRE, 52 Grove Ave., Elgin, Ill An object here is to provide a radiating system in which the heat of the engine may be retained until

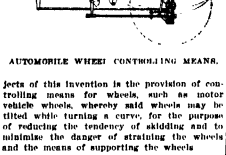


AUTOMATIC RADIATING SYSTEM FOR INTERNAL COMBUSTION ENGINES.

it has reached such a degree as to insure its most efficient working, after which a circulation of water or of other cooling medium is automatically started through the radiator, thereby tending to keep the engine from overheating.

Pertaining to Vehicles.

AUTOMOBILE WHEEL CONTROLLING MEANS.—W F MITCHELL and E E. HENRY, care of the former, 2637 Birch St., Astoria, Ore. This invention relates to carriages and vehicles, and has particular reference to the running gear of such vehicles Among the objects of this invention is the provision of controlling means for wheels, such as motor vehicle wheels, whereby said wheels may be tilted while turning a curve, for the purpose of reducing the tendency of skidding and to minimize the danger of straining the wheels and the means of supporting the wheels



AUTOMOBILE WHEEL CONTROLLING MEANS.

Designs.

DESIGN FOR A MUSTARD BOTTLE.—R. A LUSK, 238 Front St., New York, N Y. This design shows a short cylindrical neck merging into a flared shoulder, the outline of which is a compound curve Below the shoulder is a swell Under this is a straight body portion, at the lower end of which is another swell in the reverse direction of the first and merging into a small base.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Russia's Giant War Planes

(Concluded from page 131)

seconds; and that these flights were made with two 200 horse-power Salmson motors, whereas the motive power formerly employed for the Sikorsky machine took the form of four Argus engines of 100 horse-power each.

A Huge Machine

The dimensions of the "Ilya Muromets," an advance on anything previously attempted in aeroplanes, measure 121 feet in span, the chord of the planes is 9 feet, the total lifting area 1,650 square feet, and the covered-in fuselage measures 65 feet from nose to tail, and 6 feet in height by 5¼ feet in width at the bow. As will be seen from the illustration, the nose contains a small cabin for two pilots, and behind this is a cabin for passengers. Behind this again a small sleeping apartment, and still further, a very small lavatory; each compartment being lighted by electricity and heated by the exhaust from the engines. The tail consists of a fixed tail plane, a large elevator and a triple rudder with an area of about 55 square feet. The chassis comprises four large disk wheels sprung on elastic shock absorbers, which take the place of the skids which were part of the original design, but were found to develop too much friction.

Sikorsky has succeeded in developing a marvelous weight carrier. It has carried eighteen human beings, and is a very steady machine, without going beyond the ordinary accepted principles of design in aeroplanes, as understood hitherto. His only innovation has been that of large dimensions, and according to the latest information from Russia, which I have received through a most reliable source, he is not even contemplating the construction of a new type of machine.

Whatever the size of his productions may be he intends to still build to the old model. It may be noted that Sikorsky, though a young man, has studied the construction of aeroplanes in other countries than Russia, although he commenced his experiments in aeronautics there, and designed and built machines on his own account before going abroad to gather further experience. Yet he built the "Ilya Muromets" of wood throughout, mainly Russian pine and beech; and he continues to use the well-known integral propellers, the invention of M. Chauvière, which have carried so many flying machines to victory over the elements in recent times, because his experience teaches him that there are none better.

The Problem of Strength and Weight.

In attempting to deal with the greatest of all difficulties met with in the construction of the large machines with continually increasing span which are demanded by the military and naval services of the great powers for long-distance work, and fuel-carrying capacity—the relation of strength to weight—Sikorsky has been most successful.

If, while increasing the span of the machine, the designer allows no more than the same number of bracing points and keeps to the same angles for his bracing wires, he is bound to increase the size and weight of his spars to allow a proper margin of safety. This is not only necessary in order to bear the strains caused by aerodynamic reaction in flight, while the machine is new, but because lightly built machines require constant adjustment owing to the stretching of the bracing wires, and if continuously flown at short intervals soon lose their efficiency. It is, of course, obvious that the heavier spars add to the total weight, but though not quite so obvious, it is nevertheless a fact, that the weight of these spars which may be necessary to carry the same load per square foot of supporting surface will increase out of all proportion to the area and much more rapidly than the load carried by the supporting surfaces.

If it is necessary, therefore, to keep the weight down so as to bear a reasonable and safe proportion to the area, the designer must increase the number of bracing points in the same ratio as he increases the span of the aeroplane. Even this method has its limits, and every addi-

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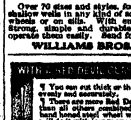
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[illegible] the resistance offered [illegible] and gives more [illegible] to the motive power in overcoming [illegible] amount of resistance which a [illegible] cord or wire opposes to the wind may be gauged from the manner in which [illegible] telephone and telegraph wires are broken in a gale, though their surface [illegible] small when at rest.

Twin Landing Chasses Suggested.

It becomes a question whether it would not be more profitable to build large machines with twin landing chasses, braced together and to the wing tips, with a central fuselage, distributing the weight in the fashion more evenly over the supporting surface of the planes. Combined with such a system of construction some method of automatic gyroscopic stabilizing, such as Sperry's, might be used in order to ease the control. It is noteworthy, however, in connection with the question of the load carried by the planes, that Sikorsky has been very successful hitherto in keeping it well within limits, for in the case of the "Ilya Murametz" the loading only amounts to 5 pounds per square foot in spite of the fact that the machine itself weighs 7,500 pounds, and it has a useful load of about 2,240 pounds. As compared with many other machines, and notably those built for racing purposes, this is quite exceptionally small and speaks well for the designer.

Size Apparently Improves Stability.

It has been mentioned that, besides being great weight carriers, the Sikorsky machines have been exceptionally stable. It is not improbable that their very size tends to make them so, because wind gusts, as compared with the volume of a prevailing wind of general uniform direction, are usually of small volume and very local effect. A large aeroplane is less likely, therefore, to be affected by them as regards its whole bearing surface and having more inherent inertia than a small one would be less liable to be overturned. Of course large machines have necessarily the defects of their qualities in this respect, in that the controlling surfaces being correspondingly large, make heavy work for the pilot in working the controls.

They consequently offer a favorable field for the use of modified automatic control by gyroscopic or other apparatus. The ideal stabilizer would be one which would be normally automatic, in order to save the pilot exertion during the greater part of the journey, and while there was plenty of room to maneuver, one which could be thrown out of gear instantly when near the ground in order that he might take complete charge of movements of the machine in a confined space, or under circumstances which required quick turning or elevating movements.

A Weakness of Large Machines.

The large aeroplane is by its very nature slow, more especially if designed to lift great weight, and variation of speeds and heavy loading do not work in together. This is to my mind the weak point of the Sikorsky machines. Speed is essential in a war aeroplane for every reason, though principally in order that it may be able to go up in spite of high wind, and incidentally for scouting purposes or to out-pace the enemy's aircraft. Variable speed is desirable for a heavy machine in order to effect safe landings. One can image a Sikorsky machine doing admirable work in patrolling a frontier, heavily armed, and capable of keeping on duty for long periods, in order to ward off an enemy's scouts, whether dirigibles or aeroplanes, but for scouting or fighting against adverse winds a maximum speed of 60 to 70 miles at least should be available. This so far has not been achieved, and practical experience can alone show whether it can be achieved with such large and heavy machines without sacrificing stability. Such experience with smaller machines in Great Britain has shown that while flying perfectly and showing admirable stability with engine power suited [illegible] they behave quite otherwise [illegible] engine power is increased, and [illegible] from the pilot [illegible]

A Solution of the Speed Problem.

A solution of the question of requisite speed may perhaps be found in the reduction of the weight for horse-power of the engines, and apparently Sikorsky hopes to find it by this means. The four Argus engines originally used by him for the "Ilya Murametz" weighed 480 pounds each, but it would be possible to get much lighter ones, either stationary or rotary. The former type would probably serve the purpose better in this case, because more suitable to journeys of long duration in that it is economical of fuel. The lesser amount of fuel which need be carried will more than make up for the greater actual weight of engine. Incidentally economy of fuel will also in time reduce the prime cost of engine, a consideration which is worth bearing in mind when numbers of engines have to be purchased for the numerous aircraft which the great powers will find necessary for the equipment of their armies and navies.

How Many Motors?

The question of multiplicity of engines in one craft is now being studied by all builders and designers of large aeroplanes, as witness the large sea-planes which are being built for the British and German governments, the Bossi and Curtiss airboats intended for transatlantic flight, and Sikorsky is no exception to the rule. The tendency at present is rather toward installing two engines of equal power, each of which alone is capable of propelling the machine, rather than to have say four smaller ones with an equal total horse-power. Time alone can show which is the better system, but it will have one inevitable result—the subdivision of labor, since the work of pilot, navigator, and mechanic in an aeroplane, so equipped, cannot be performed by one man.

The Current Supplement

THE opening article in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No 2016, deals with the timely topic of the submarine and the dreadnought, and discusses the nature of the contest between these two types in naval warfare The submarine is in reality as yet an unknown factor, and its possibilities in attack and methods of successful defense against it are yet to be learned. It is expected that much will be learned on these points in the impending European naval battles.—The protection of battleships against submarine attacks will be of interest in this connection, as it deals with the possibilities of providing armor for ships' bottoms, and raises an entirely new question.—Coal and its by-products is an unusually pleasing story, telling how coal originated, its composition and the products that are derived from it. The first installment appears in the current issue.—The evolution of coins and coinage mechanism is of value historically, and illustrates a very large number of early specimens.—The determination of plant relationship by means of serum describes a new means for the historical investigation of the origins and relationships of plants. —The meeting of the British Association in Australia is noted, with a list of the papers to be read.—Another installment of the invaluable paper on flying machines is an article that should not be missed.

A Society that Studies Instruments of Precision

THE Chronometric Society is one which has just been founded at Paris, and its first meeting took place toward the latter part of May. This association is open to all persons who are interested in the progress of chronometry and high precision mechanism, and its programme comprises all questions in this class of science or industry, viewed from scientific, technical, or historic standpoint. Its president is the well-known Prof. Lippmann, and among vice-presidents are M. Ch. Ed. Guillaume, a leading authority on metric standards, and M. P. Puiseux, the well-known astronomer.

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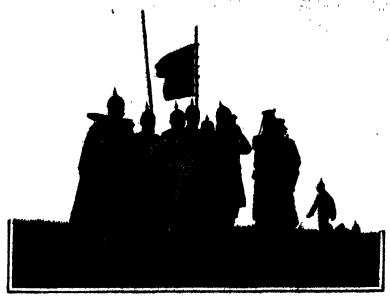
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WAR NUMBER

OF THE

SCIENTIFIC AMERICAN

ISSUED SEPTEMBER 5th

FORTY PAGES — COLORED MAP — COLORED COVER — PRICE 25 CENTS

With a view to answering the thousand-and-one questions which the public is asking about the titanic conflict which is convulsing the whole of Europe on sea and land, there will be published, on Sept. 5th, a special issue of the Scientific American of triple the size of the regular weekly edition. The issue will be arranged in two sections dealing respectively with the armies and the navies of the Triple Alliance and the Triple Entente.

ARMY SECTION

The Army Section will include chapters on:

The comparative strength of the Armies engaged, illustrated by diagrams and compiled from the latest military statistics.

The Armament, with tables showing for each power the shoulder pieces, machine guns, field guns, howitzers and siege guns, with full details of caliber, weight, velocity, range, danger zone, etc., and a description of the action of shrapnel and shell and the decisive part played in attack and defense by modern artillery.

How an army is fed during a great battle, describing the wonderful organization by which, from a central depot, miles to the rear, the rations are fed out on diverging lines, until each man on a fighting line fifty to one hundred miles in length, is supplied with food and other necessities for his sustenance and wellbeing.

The Signal and Telegraph Service. This chapter will describe the wonderful organization of telegraphs, telephones, flag and flashlight signals by which the Commander-in-Chief, at a base, many miles to the rear, is kept in close touch with the various army Corps, divisions, etc., and has his hand and eye upon a battle-front that may extend, as in the battle of Mukden, for over 100 miles.

The Medical and Ambulance Service. Only less important than fighting the battle is the speedy relief of the wounded and their quick removal to the rear as the battle progresses. This chapter will explain the highly efficient organization of the medical service in modern warfare.

Every chapter will be elaborately illustrated with photographs showing the latest rifles, guns, transport, medical equipment, etc., of modern armies.

NAVY SECTION

The Navy Section will include chapters on:

The comparative size and strength of the Navies, both of the Triple Entente and the Triple Alliance. The Scientific American has gathered these data from the most reliable sources, and they are absolutely correct up to August 15th, 1914. The tables will be illustrated by diagrams. One of these will show the relative strength in all ships combined—the other the rating in dreadnoughts.

The Contending Navies in Detail. A chapter on each of the Navies engaged in this War. Each chapter will include a photograph of one or more battleships, armored cruisers, scouts, destroyers and submarines, of each fleet, with a description of the special characteristics of each. Each photograph will represent one ship of a large class, so that any ship mentioned during the War will be represented in this issue. These views have been selected from a file of about 1000 typical ships of the World's Navies.

Tables of Naval guns showing the caliber, weight, velocity, striking energy, etc., of all the types mounted in the navies discussed.

The strategy of the Naval War, showing by the aid of a map, the enormous advantage to Germany of the Kiel Canal and the coast defense works, upon which she has spent such great sums in the past two decades.

AEROPLANES AND DIRIGIBLES

War in the Air. For the first time war will be carried into the air. For scouting, and to a limited extent for attack by bomb-dropping, the dirigible and the aeroplane will play a most important part. The number will contain a highly illustrated article covering this phase of the War.

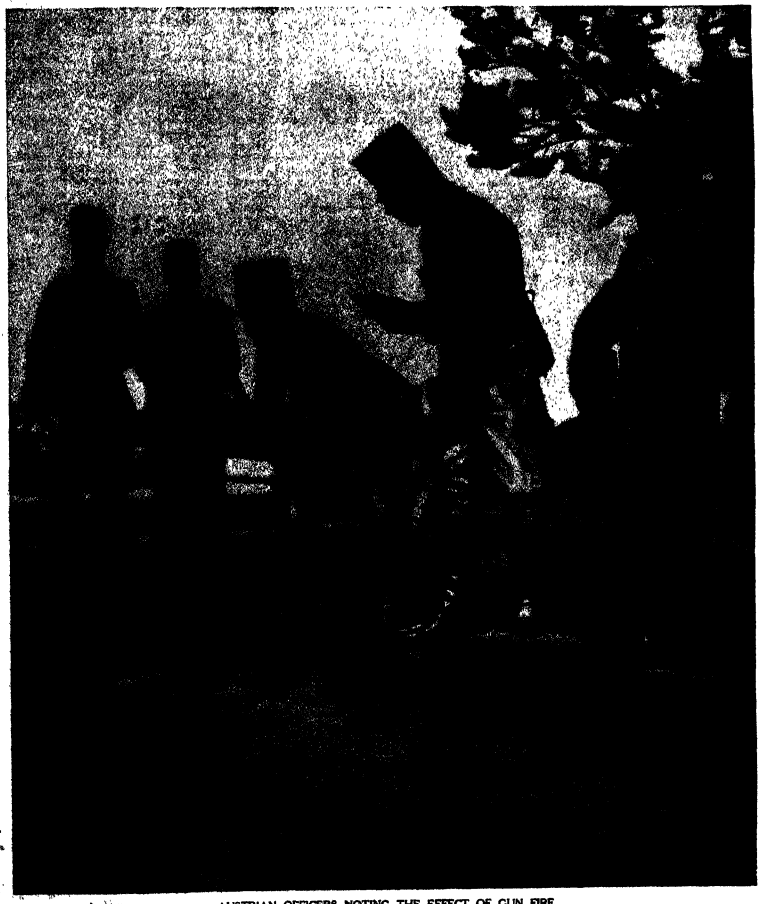
WAR MAP

The number will contain a map drawn especially for the use of those who by colored pins may wish, day by day, to trace the progress of the rival fleets and armies.

MUNN & CO., Inc., 361 Broadway, New York

16 NOV 1914

SCIENTIFIC AMERICAN



AUSTRIAN OFFICERS NOTING THE EFFECT OF GUN FIRE

Pictures of the European Armies

Onnes' Discovery of a Perpetual Current Without Electromotive Force

Vol. CXI. No. 9
August 29, 1914

Munn & Co., Inc., Publishers
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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Notice

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The Command of the Sea

THUS far, the most important lesson taught by the great European war is the supreme importance of the command of the sea. A few days ago, the German fleet, most formidable in numbers and second to none in its fighting qualities, was free to steam where it would upon the high seas, and the flag of its merchant marine was flown on every ocean and in every great port of the world. To-day, the German battle fleet is shut up in the Baltic, its cruisers, barried by the more powerfully armed ships of the allies to establish the supreme command of the sea, for want of coal, and the ships of its truly magnificent merchant marine are either sheltering in neutral ports, or are being led as captures to the home ports of the enemy.

Furthermore, so swift have been the navies of the allies to establish the supreme command of the sea, that already, within two weeks of the declaration of war, Great Britain has been able to notify her merchant fleet that the customary routes of travel have been cleared of the enemy; and she holds the North Sea so completely in her hand that already she has landed over 100,000 troops upon the German right flank in Belgium.

To our minds the most convincing proof of the cataclysmic nature of the present upheaval in Europe is to be found in the fact, that the opening of the war found both the German navy and its vast merchant marine totally unprepared for the emergency. If it does not prove that, at least it proves that Germany had not the slightest expectation that the British navy would be brought into the conflict. Had there been the slightest suspicion, at Berlin, that the violation of the neutrality of Belgium would have brought the whole British Empire to the relief of that little kingdom, it is certain that some provision would have been made for the recall of German cruisers on distant stations, and for the withdrawal of the richer prizes of the German merchant marine to the home ports of the empire.

For many a long decade to come and, indeed, until the secret and inner history of the war shall have been disclosed, it will be a profound mystery that Germany should have so ruthlessly sacrificed the far-flung fleet of her great merchant marine. For among the many great things that Germany has done in the last forty years, there is nothing finer than the zeal, ability, and brilliant success with which she has built up her merchant fleet and strung out her world-encircling lines of foreign commerce. Hence the wonder of it all, that rather than sacrifice a pre-arranged strategical line of attack upon the enemy, Germany should have submitted to the absolute wiping out of the wonderful system of ships and commerce which she had so patiently built up through the past fifty years of her existence.

For the United States, this tragedy (for it is nothing less) carries an obvious lesson. There is every probability that the conclusion of this war will find us in the possession of a numerous and well-equipped merchant marine; and if we are wise to pay heed to a warning which is so plainly written that "he who runs may read," we shall see to it that our naval strength is increased in such proportions, that such a disaster as has swept away the great German merchant marine can never overtake our own.

A Real Test for Military Aircraft

THE terrible conflict in which the greater part of Europe is now engaged will probably serve to fix the military status of the dirigible and the aeroplane. Aircraft are still military enigmas. No one can pretend that the desultory use of the flying machine during the Morocco and Balkan campaigns disclosed its possibilities and limitations in war. Indeed, the dirigible has not yet been thoroughly tested in anything like a real battle.

Of the value of the flying machine for scouting there can be no question. Bloody as the present war may prove to be, it is not likely that we shall see a German army plunging into a whole French center, under the impression that it is a mere retreating rear guard—a blunder which cost the Germans thousands and thousands of men during the war of 1870-1871 at Vionville and Gravelotte, and which might have terminated disastrously, had it not been for the stolid and unwavering bravery of the German troops in action. Nor are we likely to see a 305-meter hill captured, lost and recaptured again and again, not for the purpose of planting guns upon it in order to shell a beleaguered Port Arthur, but for the purpose of stationing on its crest scouts, whose telescopes may discern how effective was the fire of a fleet that could not see its target. Aircraft may prove instruments of mercy; for the aeroplane and dirigible have miraculously transported the all-seeing eye of a commanding officer to a height where the whole terrane lies spread out before him like a vast topographical map on which an enemy's every battery may be seen. Information which could hitherto be gleaned only by a reconnaissance in force at a cost of human life too terrible to contemplate, will now be obtained by a few pilots wheeling high in the air on high-powered machines.

But it stands to reason that a general will not permit this bird-like scrutiny of his position without attempting to thwart it in some way. Both in Morocco and in the Balkans, rifle fire was relied upon, not altogether with success, to drive off inquisitive aviator officers. In the Balkans, two pilots were killed in this manner; but on the whole, rifle fire seems only to have sent the scout to a higher level, where observation, while not so easy, was at least fairly safe. Both the Germans and the French have developed special artillery for the purpose of assailing reconnoitering aircraft. The effectiveness of this ordnance is doubtful against machines speeding along at a height of 5,000 feet and more at the rate of at least 60 miles an hour.

Can it be then that in sheer self-defense reconnoitering aeroplanes will be fought off in the air itself? Will a commander who seeks to mask his movements and his defenses pit his aeroplanes against those of his enemy? In other words, are we likely to see real battles in the air? The fact that military flying machines have latterly been armored and provided with light machine guns, would seem to indicate that some such possibility exists. That the giant Zeppelins of the German army are expected to fight has long been known. They too have been both armed and armored. Their speed has been increased to over 60 miles an hour, obviously for the purpose of enabling them to cope with the swift aeroplane.

The relation of the dirigible to the aeroplane is not clear. The war will probably decide that moot point. Perhaps dirigible and aeroplane will stand to each other in much the same relation as battleship to torpedo boat. It is conceivable that a whole flock of aeroplanes may be sent to annihilate a single dirigible and conceivable too that, thanks to its superior armament and its great speed, a Zeppelin may successfully fight off such an attack. Heroic officers can probably be found to attempt the ramming of a formidable airship—a feat which rumor with untruthful picturesqueness attributed to Roland Garros at the outbreak of the present conflict, and which was unintentionally accomplished with frightful results during the last Austrian maneuvers. It may be doubted if a flying machine could ever approach another aircraft closely enough in the face of machine gun fire, unless it be under exceptional circumstances. Naval strategists have long since abandoned the ram, for much the same reason.

It may be that the dirigible's chief effectiveness may lie in bomb dropping. Despite the questionable success of the dropped bomb in Morocco and in the Balkans, more may be expected of it in the hands of the trained French and German pilots. It is not unlikely that new ways of dropping explosives may be disclosed. Who knows but sudden night attacks may be made, in which a flying machine may swoop down out of the blackness, release its deadly load and leap up again? The feat is not utterly impossible despite searchlights, and the moral effect on the attacked force would be tremendous.

That tactics and strategy will be modified may be expected. New methods of fighting aeroplanes will probably be invented—that much may be declared even the annual maneuvers contained in Europe.

The Great Paradox

THE huge war now raging in Europe is the inevitable outcome of the unsymmetrical development of the mind of man. Perhaps the leading country of the world in the sciences and the arts is Germany. Certainly the leading country in the world in developing an aggressive and militarist policy is Germany. She is at once the most enlightened and the most reactionary of the greater nations of the earth. She is, above all other countries, the living embodiment of that monstrous paradox we call the advancement of science. Our progress in the control of nature for the benefit of mankind has been equalled only by the splendid intelligence with which we have perfected means of slaying one another. We learn how to abolish a disease and simultaneously invent a dreadnought. As scientific men, while half of us work for the establishment of heaven upon earth, the other half strengthen the possibilities of an increasingly ghastly hell. We approach the millennium and Armageddon along parallel roads.

This towering paradox will now be resolved. The destructive half of mankind have beaten their brethren in the race. The war lords triumph over the apostles of peace. For the moment the service of the devil takes precedence over the service of God. But only for the moment. Clever and energetic as they have been, the destroyers have not been clever and energetic enough. The foundations of peace are too firmly laid. The fear that civilization is now rocking to its fall is a fear without justification. The war will progress from horror to horror and with it the disgust and anger of the people will deepen. The *foolishness* of war! More and more will this thought permeate the consciousness of the whole world. Already this view is clearly expressed by countless men throughout Europe. As they suffer more they will see more clearly, and when this war ends there will be no more wars. We are not witnessing the triumph of the destroyers. We are witnessing their vast collective suicide. As ruthless as they have been in war, so shall we be ruthless for peace. At present we play their game: we fight, because fight we must. But after —— there shall be no more war lords. The paradox will be resolved. Science shall no longer ignobly serve the forces of destruction, but, released from this dire bondage, shall lend all its energies to the task of making this fair world more beautiful and more secure. The savage, trained and equipped, shall no longer preside at our councils. His day is over. His last and greatest attempt at dominance shall result in his utter overthrow and destruction, whatever be his nationality; and the race of the future will be a race of civilized men, united by the bonds of mutual interest and appreciation and developing their powers in concord in the security accorded by an agreed and permanent world-peace.

Our European War Number

WITH a view to answering the thousand-and-one questions which are being asked regarding the European war, the SCIENTIFIC AMERICAN will issue, on September 5th a special war number of at least forty pages. This issue will be similar in scope and the character of its information to the war number that we issued during the Spanish war, which so exactly met the public needs that the sale reached nearly half a million copies.

The issue will give the very latest estimate of the relative strength of the contending armies, and successive chapters will explain in detail how a great army is moved to the front, deployed in battle; kept in touch with the commander-in-chief; supplied with its daily rations and other supplies; and cared for and its wounded removed by the medical corps. Full details will be given of the armament of every nation engaged, including descriptions of the shoulder pieces, machine guns, field guns, and heavy guns for the reduction of fortifications.

The navy section will illustrate and describe the ships and guns of each navy engaged, and this section alone will contain over fifty illustrations of the principal dreadnoughts, battle-cruisers, etc., of each navy.

To enable the reader to follow, day by day, the progress of the war, the issue will contain two maps specially drawn for this purpose. The larger map in colors will cover the whole field of operations; the smaller maps, drawn on a greatly enlarged scale, will cover the German-French frontier. It will show clearly the mountains, rivers, railways, principal forts, and cities, and other strategical features of this, the main battle-ground of the war, thus enabling the reader to follow by means of colored flags the various moves of the forces engaged. The issue will be completed by a colored cover.

Electricity

Indicating Fuse Plugs.—A new fuse plug has been put on the market which is provided with an indicating pin that is driven out through the porcelain cap of the plug by a spring when a blowout occurs. This enables one to determine at a glance which plug has blown out. Even in the dark, one can tell readily by sense of touch which plug needs to be replaced.

Electric Vehicle and the Parcels Post.—The Electric Vehicle Association of America has compiled some interesting parcels post statistics with a view to promoting the use of the electric vehicle in this branch of government service. In fifty cities, having a combined population of 20,000,000, 11,000,000 parcels were mailed, and 3,500,000 parcels were received, for local delivery, from October 1st to October 15th last year. They weighed, on the average, one pound and eleven ounces, and paid 10 cents postage each. Three quarters of this mail was handled by regular carriers, and about 10 per cent, or 350,000 parcels, were delivered by automobiles, at a cost of $17,653.

Telephony in America.—On January 1st, 1914, there were 13,700,000 telephones in the world, and 32,900,000 miles of telephone wire. This country, with 9,000,000 stations, owned 66 per cent of the total number in the world; while Europe, with less than 4,000,000, owned about 27 per cent When we consider that the population of the United States is but six per cent of the world's population, and less than 25 per cent of that of Europe, our large proportion of telephone stations makes a remarkable showing. New York city alone has more telephones than Belgium, Hungary, Italy, Netherlands, Norway and Switzerland combined; there are more telephones in Chicago than in the whole of France, and more in Philadelphia than in the whole of Austria.

Electrolytic Disinfecting Fluid.—The use of electrolyzed sea water for disinfecting purposes in hospitals, public baths, schools, etc., in the borough of Poplar, London, has proved a great success. According to the recent report of Dr. Alexander, the output last year was 66,720 gallons, showing an increase of over 12,000 gallons above the output for the previous year. Eighteen thousand gallons were employed in three public baths, being supplied at the rate of 30 gallons to a pool of 85,000 gallons at the first filling, and every two or three days further additions were made. For spraying the floors of schoolrooms, 1,094 gallons were used. The cost of electricity and materials for producing artificial sea water amounted to $636. Plants for producing the electrolyzed fluid are being used in Finland, Buenos Aires and Rangoon, and a large plant is being installed at Portsmouth, where actual sea water will be electrolyzed in place of the artificial fluid used at other places.

Loud-speaking Telephone for Train Dispatching. The telephone has been displacing the telegraph on a number of roads for train dispatching, but one of the drawbacks of this method of communication has been the fact that the operator has had to wear head telephones, which are particularly annoying when there are thunder storms in the vicinity. Recently, L B Foley, superintendent of telegraphs of the Delaware, Lackawanna & Western Railroad, has installed loud-speaking telephones on the train-dispatching lines The receiver, which is more sensitive than that ordinarily employed, is furnished with a horn, something like a phonograph horn, and is mounted on the dispatcher's desk at any convenient point, so that he can receive a message without putting his ear to the receiver. The transmitter is also fitted with a horn, into which the operator can speak. No amplifiers are used. With this outfit a message may be heard in all of the loud-speaking receivers on the line within fifteen feet of any one of them.

The Wind Tunnels of the National Physical Laboratory.—Owing to want of space and the enormous expense involved, experiments in the aeronautical laboratory of the National Physical Laboratory of England are necessarily confined to small scale models. Formerly, when the science of aerodynamics was still in a most rudimentary stage, this constituted a serious drawback, since the data obtained from experiments with small models at relatively slow wind velocities could not be applied with any degree of certainty to full-sized machines moving at high speeds. But, chiefly as the result of work carried out at this very laboratory, a law of dynamical similarity has now been evolved which enables model tests to be applied with a high degree of accuracy to large aeroplanes. The principal part of the equipment consists of two wind-tunnels, respectively 2 feet and 4 feet in diameter, to which another and larger tunnel, measuring 7 feet in diameter, is about to be added Accurate measurement of the wind velocity is a difficulty, but a sufficiently sensitive and accurate anemometer has now been designed consisting of a combination of a Pitot tube and a static-pressure tube. The models are suspended in the center of the tunnel, and the pressures and forces exerted upon them by the air-current measured by means of a delicate balance. So exact are the measurements thus obtained that they can be relied upon to within one half per cent.

Science

Artificially Cooled Buildings.—The authorities in charge of the construction of buildings at Delhi, the new capital of India, are investigating a plan of providing outer and inner walls, between which artificially cooled air can be circulated by means of exhaust fans, the cooling being effected by drawing currents of air through wetted screens.

An Archæological Atlas of Ohio has been published by the Ohio State Archæological and Historical Society. The author is Dr William C Mills, curator of the society's museum. The atlas includes county maps, showing the mounds, village sites, rock shelters and other archæological features, also maps of the early Indian trails and towns Several photographs are included

A Statue of the Late Edward Whymper, the celebrated mountaineer, is to be erected next year at Zermatt, Switzerland, to commemorate the fiftieth anniversary of the first ascent of the Matterhorn, July 14th, 1865. It will be recalled that this feat was attended by one of the worst disasters in the history of Alpine climbing The descent had hardly been begun when one of the party, Mr. Hadow, lost his footing and fell to a depth of 4,000 feet, dragging three of his companions with him to destruction Whymper and two guides were saved only by the breaking of the rope

Thumbs of the Apes. The gorilla and chimpanzee which belong to the higher order of apes, have many points of resemblance to man, but there is one thing they cannot do—that is, twiddle their thumbs. In the gorilla, the thumb is short and does not reach much beyond the bottom of the first joint of the forefinger It is very much restricted in its movements, and the animal can neither twiddle his thumbs nor turn them round so that the tips describe a circle There are the same number of bones in the hand of the gorilla as in the hand of a man, but the thumbs of the monkey have no separate flexor or bending muscle This is why a monkey always keeps the thumb on the same side as the fingers, and never bends it round any object that may be grasped

Tin Disease and Polar Exploration. Under this heading, Mr B. T Brooks, of the Mellon Institute of Industrial Research, contributes to *Science* a plausible suggestion to account for the mysterious loss of gasoline from tins which embarrassed the antarctic expeditions of *Amundsen and Scott*, and was even a principal cause of the disaster that befell the latter It appears that at low temperatures ordinary tin is liable to be converted into the allotropic form, gray tin powder This change takes place at a maximum rate at -48 deg Cent (—54 4 deg. Fahr.), and may occur more slowly at other temperatures below 18 deg Cent. (64 4 deg Fahr.). Hard solder, which may contain 65 per cent tin, is subject to the same process of disintegration Hence the danger of leakage along the soldered seams of the container, a fact that should be duly considered by future polar expeditions

The Experiment Station Record, published by the U S Department of Agriculture since 1889, is now in its thirteenth volume, and has gradually grown in capacity, until it now consists of twenty numbers to the year. To anyone who wishes to keep abreast of the world's progress in any department of agriculture this journal is indispensable, as it consists almost entirely of abstracts of current agricultural literature, drawn from every corner of the world and from a great number of languages Two general indexes have been published one for volumes 1-12, the other for volumes 13-25 Each of these is a bulky volume (the second contains 1,159 pages) and is the key that unlocks a vast library of agricultural literature The *Record* is more comprehensive than the somewhat analogous monthly publication issued by the International Institute of Agriculture in Rome, and, in particular, covers the strictly scientific and technical literature much more fully

Protecting the British Flora. We have heard for some years of the efforts made by certain societies in the British Isles to preserve the flora of those islands from devastation at the hands of persons who collect flowers and plants either for their own pleasure or for sale Recently the scope of this protective campaign has been enlarged to take account of injuries done to plants from natural or indirect artificial causes. Mr. A R Harwood has called attention to the far-reaching importance of these effects Thus periods of drought cause the extermination of many plants, montane and ericetal species being especially susceptible. Bog-pools are liable to be completely dried up, with partial destruction of their flora Drainage seriously disturbs the natural vegetation of a country Thus the typical flora of the Fens is disappearing Peat-cutting in Ireland has similar effects Deforestation works striking changes in the flora. Golf-links have been detrimental to certain species of limited distribution. Mr. Harwood urges that wherever these and other similar causes are at work, efforts should be made to obtain, in the case of an association of plants, a reservation, and in that of a single station for a rare plant, some adequate means of protection.

Night Landing Signals for War Aeroplanes

Two Luminous Circles That Help Airmen to Alight in Safety

By Our Berlin Correspondent

SEARCHLIGHTS have been used successfully by aeronauts and airmen for finding their way by night or in dense fogs. A Berlin architect, Edgar Hönig, has recently patented a new type of optical signal likely to prove even more useful in this connection, which, moreover, lends itself to a multitude of other applications.

This signal comprises a system of two or more circles (or similar figures), arranged behind, inside, or below one another, vertically or horizontally, so that their centers will coincide. Their peripheries are, by night (or in case of a fog), lined with lamps of proper luminous intensity.

This system is of remarkable simplicity and affords a most reliable means of indicating to aircraft or vessels their position with regard to a given point (vertically and horizontally), by observing the variable perspective of the circles as seen at a variable angle. When looked at from the front, they, in fact, appear as circles, from the side as vertical, and from the top as horizontal ellipses. Their intersection affords additional hints as to their position with regard to the observer.

The arrangement so far chosen comprises two vertical glow-lamp circles of different diameters installed behind one another, on the ground, so that an airman will see two concentric circles at the moment his aeroplane is on or close to the landing ground. By a proper arrangement of the luminous circles (at right angles to the landing ground and at right angles to the landing outfit) it is thus possible to give the airman accurate signals as to the direction to be chosen and as to his distance from the ground.

The airman, then, in landing should so control his aeroplane that the two luminous ellipses lying above one another are seen to intersect, in order afterward to soar down toward them, until the ellipses are slowly changed into circles, and, so far from cutting one another, approach the position of concentrical circles. At the moment the circles are seen apart, he knows his aeroplane to be only a few meters distant from the ground, and may commence landing operations in the direction of the optical signals.

In Fig. 1 the variable appearance of the circles is illustrated: When an observer is in position *C*, he will see two concentrical circles; in position *A*, he will see two intersecting ellipses, and in position *B*, two ellipses situated behind one another. By simply measuring the visual angle of the signal, its distance from the observer is readily gaged; for the position of the small circle with respect to the large one is a direct index of position of the aeroplane with respect to the large circle. Thus, if the small circle shows to the right of the big circle, it indicates that the aeroplane is also to the right. In the diagram, the figure at the extreme left shows how the signal would look to an aeroplane coming directly toward the landing place just before reaching the ground, the next view would indicate that the aeroplane has swung too far to the left, the third that it has swung too far to the right, while the fourth, with the circles concentric, that it has made a perfect landing. The fifth figure shows how the circles would appear after the aeroplane had risen a short distance above them.

The applications of this optical signal are many. On flying grounds, aerodromes, provisional intermediate landing grounds, it should be installed permanently. During army maneuvers and in warfare it may be readily carried by the troops, along with the tents, etc., in order at nightfall to be used for the airmen expected to arrive. It should render similar services to the navy, in connection with hydro-aeroplanes, and finally, it may prove of the greatest usefulness in navigation for signaling the entrance to a harbor, the more so as there is no risk of confusion with other lights.



Test of the two-circle landing signal.

London's Water

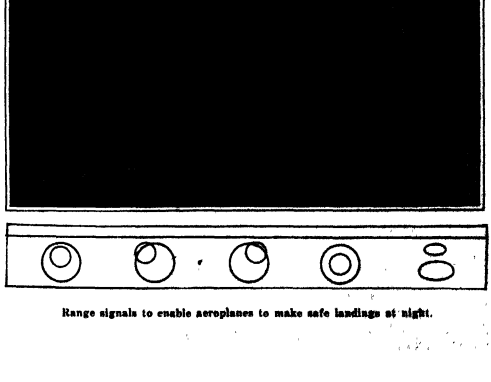
SOME important aspects of the water supply of the metropolis were the subject of an interesting communication made at Hackney recently to the members of the Institution of Municipal and County Engineers by Mr. William B. Bryan, M. Inst. C.E., the chief engineer to the Metropolitan Water Board.

Mr. Bryan dealt first with the Lea Bridge pumping station. This plant now consists of four vertical triple-expansion engines, capable of lifting 52,000,000 gallons daily; three Cornish pumps of 23,000,000 gallons capacity; two compound rotary pumping engines, 8,000,000 gallons; one compound horizontal, 3,000,000 gallons; four turbines, 2,750,000 gallons; one triple-expansion Worthington, 10,000,000 gallons; and, in addition, two horizontal engines for pumping water from the wells to the surface of the ground.

The vastest work described by Mr. Bryan was the King George's Reservoir, which has a top water area of no less than 425½ acres, and which contains when full the enormous quantity of 3,073,000,000 gallons of water. Londoners will learn with satisfaction that this great reservoir has been practically full during the whole of the recent spring and early summer; in fact, at the present time so high is the water-level that the pumping is necessary. A brick channel takes the stored water in a southerly direction to Chingford Mill, where it joins former channels connected to the chain of reservoirs commencing near Higham Hill. All these reservoirs are filled by gravitation, with the exception of the Banbury and Lockwood reservoirs, which can only be filled to half their capacity in this manner, and water is pumped into them from a pumping station half a mile south of Chingford Mill by three vertical compound pumping engines, attached to which are centrifugal pumps, each capable of delivering 40,000,000 gallons per day into the reservoirs.

The Humphrey pumps at Chingford have created unusual interest by reason of the fact that the plant is unique in waterworks construction. There are four pumps with a capacity of 40,000,000 gallons per day each, and there is one pump of 20,000,000 gallons capacity.

Each pump may be looked upon as a gas engine and pump combined, but without piston, crosshead, connecting rod, crankshaft, flywheel, bearings, gearing, or stuffing boxes. The action of the pump can best be understood by picturing a horizontal pipe connected by two bends at its ends with a vertical closed-top combustion chamber and an open-top water tower, respectively. The parts thus connected are nearly full of water, forming a heavy mass or column, which is made to oscillate under the action of the explosion. This oscillation is quite free, and occurs in such a manner that the movement of the water causes the intake of a fresh charge of combustible mixture, the compression of the mixture, the explosion and expansion which gives the power stroke, and the exhaust of the burnt products. Thus there are four primary movements of the water during each cycle, two being from the combustion chamber toward the tower and two in the opposite direction. With each explosion of one pump twelve tons of water can be delivered into the reservoir.



Range signals to enable aeroplanes to make safe landings at night.

Fused Twins

THE four-legged chick, although a phenomenon known from early historical times, on its appearance in a community never fails to create a stir. Usually it receives notices in the nearby country papers, and various weird explanations are furnished.

However, embryologists now know that this peculiar monster simply represents one form of fused twin. The human race presents as many degrees of this strange tendency as are seen in any race. At one extreme is the degree of fusion seen in the Siamese twins and other examples where a pair of individuals are joined by a simple fleshy link.

The other extreme is much more common and exists where there is a duplication and multiplication of minor parts. For example, a man with a well developed extra row of teeth is an involuntary cannibal who has absorbed his twin brother. The case of the individual with a sixth finger is more puzzling. *Polydactylism*, as it is called, is known to be an inheritable character; and whether it is simply the inheritance of the tendency to imperfect twinning or something else, it is nevertheless a true Mendelian character.

A century and a quarter ago, Geoffroy St. Hilaire made a careful study of human monsters, and arranged them into several hundred species, thirty orders and a dozen classes. Nearly all of these are now recognizable as various degrees of fused twins.



Plant for liquefying methyl chloride, ethylene, oxygen, and air.

In the center, the four white apparatus are respectively, ethylene, oxygen and air liquefiers and the final receptacle for air.

A Permanent Electric Current Without Electromotive Force*

The Latest Discovery of Prof. Kamerlingh Onnes

WITH the help of hydrogen, which was first liquefied by Dewar, in 1898, it was possible to carry on investigations between — 253 and — 259 deg. Cent., these temperatures being only 20 to 14 degrees above the absolute zero; when in 1908 Prof. Kamerlingh Onnes succeeded in liquefying helium he placed at our disposal a range of temperature which is only 4.3 to 1.8 degrees above that point (— 273.1 deg. Cent.) and in one experiment even reached 1.15 degrees above the absolute zero.

In experiments undertaken at temperatures produced by means of liquefied hydrogen, it appeared that various properties of matter are modified to a great extent upon approaching the absolute zero. This would lead to the inference that still greater variations in these properties should result upon cooling with liquefied helium.

For this reason, Prof. Onnes did not look upon this result as an end in itself, but rather considered it the beginning of a new period which marked the discovery of a mighty weapon which might aid him in his efforts to fathom some of Nature's secrets.

It is known that the resistance of metals is diminished with decrease in temperature. The rate for a given metal depending upon the degree of purity; i. e., the purer the metal, the greater the decrease of resistance with decreasing temperature. In the case of exceedingly pure platinum, it was found that the resistance at the lowest temperature obtainable with hydrogen is only 1/100 of the value at ordinary temperatures, while for exceedingly pure gold the ratio is only 1/300.

According to the view generally held by scientists at the present time (for which Prof. Lorentz is responsible), the electric current is a continuous movement of very small electrical particles, known as electrons. These electrons are free to move between the molecules of a conductor. If they possess sufficient velocity, they may even penetrate the molecules. If, in one way or another, these electrons are subjected to the action of a force which pushes them in a given direction, all the electrons (at least on an average) will assume a movement in that direction. If this force ceases to act, this movement will soon come to an end, and the general velocity of the electrons will be lost as a result of collisions with the molecules, or with certain parts of the molecules, at least, as a result of the influence of the molecules, of which influence, we, as yet, know very little. In order that the movement of the electrons may continue in a given direction a continuous force like an electro-motive force is required.

It would take us too far to go into a detailed explanation of the various views which have been advanced on the factor upon which the intensity of an electric current depends which is produced by a given electro-motive force in a given instance. I shall mention only two of these factors: First, the number of above-mentioned electrons which are to be found in a unit volume of the metal; second, the distance over which an electron is free to move before it will collide with, or be attacked by a molecule and retarded, after which it will be pushed forward again, but in a direction considerably different from the one in which it moved originally. It is quite evident that a given electro-motive force will produce a stronger current, that is, the resistance to the passage of the current will be smaller, the greater the number of electrons present and free to move, and, also, the greater the average path of motion, that is to say, the greater the distance over which each electron is free to follow the impulse of the force.

Up to 1910, Kelvin's theory was commonly accepted that at very low temperatures, the electrons attach themselves to the molecules to a greater and greater extent, and that the electron vapor, which at normal temperatures lies between the molecules, eventually would, at very low temperatures, so to speak, condense on, or even freeze to, the molecules. This theory would lead us to believe that upon approaching the absolute zero, the resistance would not continue to fall, but would eventually increase materially.

Prof. Onnes was anxious to see if this would actually take place at the temperatures of liquefied helium. However, no evidence, or even indication, of an increase of the resistance could be established. Instead, he arrived at the conclusion that with absolutely pure platinum the resistance would be so small that it would be non-measurable and that other metals would probably act in the same way at somewhat higher or lower temperatures.

Prof. Onnes chose the metal mercury for his further researches on the lowering of resistance. Not only was his hypothesis confirmed, but to his astonishment the results obtained went even further. At the boiling point of helium, or at 4.3 degrees above the absolute zero, or at 4.3 deg. K. (Kelvin's abbreviation, this being the usual terminology) the resistance had fallen to 1/500 of the value for the resistance of solid mercury at 0 deg. Cent. (this value being obtained by calculation for degrees above the melting point). At 4.21 deg. K., the resistance became a little lower, but then came an altogether unexpected occurrence: it decreased suddenly with great rapidity, so that at 4.19 deg. K. it was too small to be measured, being less than 1/10,000,000 of the value at 0 deg. Cent.!

The apparatus for measuring resistance was made more sensitive, when it was found that at 2.45 deg. K. the resistance was, apparently, less than 1/500,000,000 of the value at 0 deg. Cent. Prof. Onnes was justified in applying the term *super-conducting* to the state of mercury at temperatures below the breaking point (4.19 deg. K.).

We have constantly spoken of resistance, but Prof. Onnes remarks that we cannot be at all sure that in the super-conducting state the same laws hold as in the ordinary conducting condition.

We have but a vague idea of the changes in a substance which give rise to the above-mentioned abnormal increase in conductivity. However, this much can be said, that the average path of motion of the electrons —second of the factors mentioned above—assumes a large value: Prof. Onnes estimates it at about 1 meter

* Vienna Radiotelegraphic Congress, Saturday 11 July, 1914. Abridged.

at 2.45 deg. K. In all probability then, to a great extent, the molecules lose the power of attacking and diverting an electron from its course when the latter starts to penetrate the former.

The exceedingly high conductivity of super-conductors makes possible the transmission of strong currents through such wires. At 1.7 deg. K., it was possible to send a current of a density of almost 1,000 amperes per square millimeter through a thin mercury wire 1 meter long without a difference in potential being noticeable at the ends of the wire and without the development of heat.

However, there is a limit to the intensity of the current which cannot be surpassed at a given temperature if the current be transmitted through a mercury wire of a given diameter, if it be desired that the mercury remain a super-conductor. If the density of the wire be increased to a certain value, the so-called basic value of the density, the wire will assume its ordinary resistance. This basic value of the density is greater the further below the breaking point the value of the temperature.

It was of great importance that Prof. Onnes discovered that, upon cooling in liquefied helium, tin and lead also became super-conductors. The breaking point of tin is at 3.8 deg. K.; at 1.8 deg. K. the resistance falls to less than 6/10,000,000,000 of the value at 0 deg. Cent.; lead is a super-conductor at the boiling point of helium; and its breaking point lies at about 6 deg. K.; at 1.8 deg. K., the resistance is less than 1/20,000,000,000 of the value at 0 deg. Cent.

Prof. Onnes had a coil made from an extremely fine lead wire (diameter 1/70 millimeter), 1 centimeter long, which contained 1,900 turns per centimeter. Apparently, this coil also became a super-conductor if cooled in liquefied helium. At the boiling point of helium, a current of 0.8 ampere could be transmitted through this wire (which at normal temperatures had a resistance of more than 700 ohms) without encountering any resistance.

This is of the greatest importance for the following reasons. By using a certain mixture of iron and cobalt for the pole pieces Prof. Weiss of Zürich has succeeded in making an electro-magnet with an intensity of 55,000 gauss. Scientists, however, aim at an intensity of 100,000 gauss. It is impossible, however, to obtain such an intensity by means of an electro-magnet, the core of which produces the intensity, because the core becomes overcharged by the magnetic influence. If a current passes through the windings of a coil (without a magnetizable core) the coil itself will produce a magnetic induction. By increasing the turns per centimeter length of the coil (which also necessitates increasing the length of the coil so as to eliminate the so-called anti-magnetizing influence of the ends), and by increasing the *strength of the current*, it is *theoretically possible* to produce a magnetic intensity of any degree desired within the coil. However, the difficulty lies in removing the large amount of heat generated in overcoming the resistance of the windings. Perrin, in 1907, proposed cooling the coil with liquid air so as to take advantage of the increase in conductivity with decrease of temperature, as well as to remove the heat produced. Fabry calculated that this would require the evaporation of 1,500 liters of air per hour, and the cost would equal that of building a battleship.

It made quite a difference when it was found that lead became an exceedingly fine conductor at the temperature of liquefied helium. The heat to be removed would be 1,000,000,000 times smaller than in the case of ordinary conductors. Apparently it would be possible to obtain a magnetic intensity of the degree mentioned above with a lead coil 25 centimeters in diameter cooled in liquefied helium. According to Prof. Onnes, the cost of this would be moderate.

But it was found that the above-mentioned lead coil remains a super-conductor for small current density at the boiling point of helium as long as the magnetic intensity is less than 500 gauss. If the magnetic intensity should rise above this amount (at a low density), the basic value of the intensity at this temperature lies, for lead, between 500 and 700 gauss, at 1.8 deg. K. it is 1,000 gauss) the lead coil suddenly acquires a considerable resistance.

It is evident that a new obstacle has been placed in the path of the project for producing an electro-magnet of 100,000 gauss with the aid of a super-conductive metal. Part of the coil itself would necessarily be subjected to the action of a strong magnetic field and this part would no longer be a super-conductor, so that the advantage of cooling in liquefied helium would be to a great extent, or entirely, lost. This result was somewhat of a disappointment, but then again a new property was discovered which will help us to a better understanding of the subject.

Prof. Onnes now proceeded to the following experiment, which he had thought of previously and which clearly demonstrates the exceedingly high conductivity in the super-conducting state.

When a momentary electro-motive force acts in a circuit, a current is generated. But it is soon exhausted by the resistance of the metal. If the resistance of the metal diminishes, then the time required for the current to die out, after the electrical force has ceased to act, will increase. With ordinary conductors this time is but 1/100,000 of a second.

Prof. Onnes calculated that, with the above-mentioned lead coil, if the latter were made a super-conductor, it would take more than a day for the current to die out. The test was made as follows:

The ends of the lead wire were first fused together, so that the wire itself might form a super-conductor when plunged into liquefied helium. At the beginning of the test, the lead coil in the tube into which the liquefied helium was to be poured, was placed between the poles of a large electro-magnet. This coil was placed in such a way that the coil surface was perpendicular to the line connecting the poles. The electro-magnet was then charged and an intensity of 200 gauss produced. At this stage the lead was still an ordinary conductor and the induction current produced by this operation immediately died out again. Helium was then poured in and the temperature reduced to 1.8 deg. K. by exhausting the vapor. The magnetic field produced by the electro-magnet was then destroyed by breaking the feed current and removing the electro-magnet. This caused an induction in a direction opposite to that of the one previously mentioned. From the results obtained by Prof. Onnes in the experiments, mentioned above, he was justified in making the assumption that, under these conditions, the lead would remain a super-conductor; the magnetic intensity was less than its basic value, and, according to calculation, the current produced by induction was less than the intensity equivalent to this basic value.

The experiment fulfilled absolutely all expectations. As a matter of fact, a current did continue to run through the coil, a conclusion which was justified by the effect of the coil on a compass needle. The strength of this current was 0.4 to 0.6 ampere, a value which could be derived from the intensity of current which had to be transmitted through another coil, of proper dimensions, to counter-balance the effect on the compass needle of the current in the original coil. No decrease in strength could be observed for a full hour. If the coil were removed from the liquefied helium, and, therefore, the temperature were raised beyond the breaking point, the coil acquired an appreciable resistance, and the current died out within a short time. The experiment was repeatedly made and the results obtained were always confirmed. The fall in current amounted to only 1 per cent per hour at 2 deg. K.

To show that an electric current does circulate from the action of the lead coil on a compass needle, a galvanometer was connected in shunt with the lead coil, and after a current had been generated in the coil the lead wire was then broken between the terminals of the galvanometer, cutting out the super-conductor and making the electric current pass through the galvanometer. Immediately the latter registered, and because of the resistance in this conductor, the current was quickly exhausted and the galvanometer soon returned to zero.

It is hard to say whether in the future this discovery will be of any direct value from a technical standpoint. But there can be no doubt that it is of great value to science. And in this way it must necessarily benefit the technical world and society, indirectly, in proportion to its scientific importance, for, in this era of constant, intimate co-operation between science and technology, every increase in our scientific knowledge of phenomena has a marked influence on industrial and technical applications.

The Current Supplement

INVESTIGATIONS at the Cryogenic Laboratory at Leyden is the leading article in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2017, and gives an interesting insight into the remarkable investigations made by Prof. Kamerlingh Onnes in the regions of extreme cold, a degree of cold in which hydrogen and helium are liquefied; and another article, by Prof. Onnes himself, gives the first account of a remarkable discovery in relation to the action of electricity in extremely low temperatures, "endless electricity" it has been termed.—The instructive article on coal and its by-products is concluded.—There is another installment of the article on the flying machine, by Mr. Lanchester, which is of value to every engineer. Aerial reconnaissance discusses a new use for the aeroplane.—Prof. Hugo de Vries of the University of Amsterdam discusses the principles and theory of mutation.—There is a paper on producer gas in a manufacturing establishment.—Linking India and Ceylon by railway tells of railway development in the Far East, and another articles describes an English airship of improved design.

A Century of Dreadnoughts

By Percival A. Hislop

ON December 1st last there was launched at the yard of the Mitsu Bishi Company, Nagasaki, the Japanese cruiser "Kirishima," and to this vessel is attached the honor of being the first ship to carry sixteen 6-inch guns on a displacement of 27,500 tons. She belongs the distinction of being the hundredth ship of the dreadnought type to go afloat. The pioneer ship of the type, the British 17,900-ton battleship "Dreadnought," was launched on February 10th, 1906, so that the "all-big-gun" ship has been a little under four years reaching its "century." The rate of increase, so far as the principal Powers are concerned has been as follows:

Launched in	'06	'07	'08	'09	'10	'11	'12	'13	Total
Britain	1	6	3	3	4	6	3	4	30
Germany			4	4	3	4	3	4	22
United States			3	3	1	2	2	2	13
France						3	2	2	7
Italy					1	1	2	1	5
Japan						1		1	2
Russia					4	4			8
Austria					1	1			2
Brazil			1	1			1		3

In this table the number of ships accounted for is ninety-four. The balance is made up by two ships launched for the Argentine Republic in 1911, two launched for Spain in 1912 and 1913, respectively, and one launched for Chili and one for Turkey in 1913. It will be noticed that Brazil is credited with three ships in the table. The third vessel, the "Rio de Janeiro," is, however, in the market at the moment of writing, and there is keen competition between Austria and Greece for the possession of the ship, which has the unique main armament of fourteen 12-inch guns in seven center-line turrets.

Great Britain naturally takes the lead as a dreadnought power, but it will be seen that her superiority over her nearest competitor is only 50 per cent, and, further, that she has only launched twenty-six dreadnoughts, while Germany has launched twenty-two. These two powers account for fifty-five ships of the type, leaving forty-five to be distributed among the remaining eleven nations which have so far launched a ship of this class. Europe is divided politically into two great camps, the Triple Entente (Britain, France, and Russia) and the Triple Alliance (Germany, Italy, and Austria). The former have forty-five and the latter thirty-one dreadnoughts afloat—a total of seventy-six; so that only twenty-four ships remain after deducting those that contribute toward making Europe the armed camp that it is. America claims sixteen ships—ten in the North and six in the South—and the balance is made up by the Japanese quintette and the three ships which Spain and Turkey divide between them. There is a striking moral for Americans in the fact that while the United States Navy is less than half as strong in dreadnoughts as the German, the position in 1908, when both nations launched their first dreadnoughts, was that the United States had thirty-four completed armored ships not over ten years launched to Germany's twenty-five.

The idea seems to be gaining ground that there is a tendency to reduce the size of battleships, or at any rate to put a decided check upon the rate of increase in displacement. Taking the eight principal powers, there were thirteen battleships launched in 1906—the year before the first dreadnought went afloat—and they averaged in displacement 14,462 tons. In subsequent years the figures, as regards dreadnoughts, have been as follows, it being pointed out that for some of the latest ships the displacements are not absolutely official:

DREADNOUGHT LAUNCHES.

Year.	Ships.	Total Tons.	Average Tons.
1906	1	17,900	17,900
1907	6	107,580	17,930
1908	10	184,180	18,418
1909	10	206,325	20,632
1910	9	195,955	21,773
1911	27	627,230	23,234
1912	17	406,900	23,935
1913	20	498,000	24,900

It will be seen that the period of greatest increase was between 1908 and 1911, which is just the period when competition in this class of ship began to manifest itself. As regards present tendencies, those who foretell the gradual reduction of battleship displacements base their arguments mainly upon the fact that, while the ships laid down under the British programme for 1912 ("Queen Elizabeth" class) will be of 27,500 tons, those of the 1913 programme ("Royal Sovereign" class) will be some 2,000 tons smaller. They altogether ignore the fact that while the "Queen Elizabeths" are to steam 25 knots, the later batch will steam no more than 21 or 22; and the addition of three or four knots after the twenties have been entered makes a vast demand upon tonnage. The "Queen Elizabeths" have the advantage of oil fuel, while their successors are to burn coal; but this cannot, after all, have made a great deal of [illegible]

...ing to the tremendous strides in speed, be... ...ing correctly, the "Royal Sovereigns" ... ...ere the most powerful ships afloat as against eight. ... ...e the further fact to be considered that as ... ...ship is the biggest fish in the sea—so so it is said—than ... ...e ships out of it, so there are bigger ships on the ... ...than any yet afloat. The heaviest ships yet ... ...are the German battle-cruisers "Derfflinger" ... ...Lützow" and the Chilian battleship "Almirante ... ..." all of 28,000 tons. Compare this with the ... ...of certain ships now building. The first battle... ...of the new Italian programme—virtually repro... ...ductions of the British "Queen Elizabeth" design—will ... ...displace 25,510 tons apiece. In Japan there are under ... ...construction the "Fuso" and three sister battleships, ...of 30,000 tons displacement, designed to carry twelve ... ...inch guns and to steam 22.5 knots. The United States ... ...navy "Pennsylvania" and her successor will displace ... ...31,000 tons apiece; while there are even heavier vessels ... ...at this moment in hand—the Russian battle-cruisers ... ...Sinbourn," "Ismail," "Borodino," and "Navarin," which, ...carrying nine 14-inch and twenty 4.7-inch guns and ... ...attaining 26.5 knots, will displace 32,200 tons. Battle... ...ships may or may not decline in dimensions in the near ... ...future; but, at any rate, there is no concrete evidence ... ...of any such development.

It is said that torpedo attack from submarines is the factor which has doomed the heavy battleship, and that this class of warship will be reduced in size in order to minimize the area of the target offered. The same argument might have been advanced at any stage of naval development; but the line of advance followed by every naval power has, in recent years at all events, been this: that the best defense against guns is to smash them before they can harm you, and that the best defense against underwater attack is a hull of such size and strength that a torpedo or two can make but little impression on the structure as a whole. Tonnage means strength; and although it also means ability to be hit, the former increases at a far greater rate than the latter. Let the comparison between the "Florida" and the "Pennsylvania" speak for itself:

	Florida.	Pennsylvania.	Pennsylvania Greater by
Target:			
Length, ft.	510	600	17.6 per cent
Draught, ft.	28½	28 ft. 10 in.	1.2 " "
Defense:			
Main belt	11 in.	14 in.	27.3 " "
Tonnage	21,825	31,400	43.9 " "
Offense:			
No. of guns	10	12	20.0 " "
Broadside	5,700 lb.	16,800 lb.	93.1 " "

In face of such facts as these, can it be doubted which is the better investment? Battleships increase in size because they can give more and stand more knocking about for every additional ton of displacement.

How Much It Costs to Kill a Man in Battle

IN *La Science et la Vie*, Gen. Percin of the French army states that he read in an American newspaper that to kill a man in modern warfare costs in the neighborhood of $15,000. "This figure seeming to me to be excessive," he says, "I sought to verify it. My results show that really the newspaper was below rather than above the truth. To get at the cost of killing one soldier it is necessary to divide the cost of the war to one of the belligerents by the number of men killed on the other side.

"In 1870-71 France spent about two billions of francs in the actual warfare and a billion more in restoring its own property and in payments for injuries caused to others, which it is perfectly fair to include in the costs. Then there were five billions for war indemnity and still two billions more for interest, loss of revenue and seizures by the enemy for maintenance during the German occupation. The last may or may not be a cost in a given war, so that it had better be left out of the reckoning. In the same way the Russo-Turkish war of 1877-78 cost two billion francs to the Turks, and the Russo-Japanese war, 1905, cost the Russians six billions. In the Franco-Prussian war there were 28,600 Germans killed or mortally wounded; in the Russo-Turkish war, 16,600, and in the Russo-Japanese, 58,800, in the latter instances, of Russians and Japanese, respectively. From these figures it is evident that the price per man killed to the opposing side was, in 1870-71, $21,000; 1877-78, $15,000, and in 1905, $30,400, all of the figures in excess of those named in the American journal.

"I rather expected when I undertook this calculation to find that the costs were increasing. On the one side the engines of war cost more as they are perfected. On the other hand, progress in the art of killing is always surpassed by progress in the art of defense. The result is that the ratio of men killed or wounded in actual battle is continually diminishing. This ratio was 1 per cent under Frederick the Great, 3 per cent under Napoleon, 5 per cent in 1870, and ½ per cent in Manchuria. But in 1870 there were not a dozen great batteries. The Prussian armies fought little between Frœschwiller and Sedan and the French little between Sedan and Coulmiers. The fight was taken up again in December, but less sharply than at the beginning. During much of the time men did not kill, but the expenses never ceased. In Manchuria, on the contrary, they fought nearly every day. The battles were long ones, fifteen days at Mukden, twelve at Cha-Ho, and eight at Liao-Yang. This increase in duration of the battles compensates for the slight loss in any individual hour of the fight. One may see also why the cost of a man killed is not higher in 1905 than in 1870.

"It will be impossible to predict with exactness how much it will cost per man killed in the next war; the sum will depend upon the nature of the struggle. If fighting continues nearly every day, as in Manchuria or in the Balkans, the cost will be approximately the American estimate. If the battles are as in 1870, at rare intervals, the cost will increase in very appreciable ratio. It will not diminish, that is certain.

"That which kills and reduces efficiency in war is not the cannon or the rifle, but fatigue, cholera, and typhoid. In 1870 there were registered in the hospitals no less than 380,000 Germans, who, although they survived, were inactive for some time. The Crimean war cost the Allies four times as many deaths from sickness as from battle. This ratio was three to one among the Russians in 1877-78 and only two to one among the Japanese, thanks to their excellent hygiene. I count more, therefore, on improved hygienic methods and the art of avoiding losses in war than on progress of ballistics and of the means of destruction."

Adolf Martens

BY the death of Adolf Martens the engineering world has lost an imposing figure, and one of unusual ability and force of character. Born in Backendorf in the year 1850, he received his early education in Schwerin and Carlottenburg, and later received the honorary degree of Doctor of Engineering at Dresden. During a long career of usefulness, Martens gave his special attention to investigations in relation to the various materials employed by engineers, in which direction he appears to have been possessed of unusually keen and discriminating powers. His work was held in high esteem by engineers in all parts of the world; and it was greatly regretted when, in later years, he was obliged to give up his work of investigation to assume an administrative office as director of the Royal Material Testing Office, which consumed his entire time.

Adolf Martens is best known through his work on "Testing Materials," which has been translated from the original German into English, French, and Russian; besides which he has been a frequent and valued contributor to various technical and scientific publications. He was a lecturer at the Charlottenburg Technical School and a member of the Berlin Academy of Sciences, as well as of many other technical societies.

Besides his notable distinctions in the scientific world, Martens attained high honors in the social life of his country, and at the time of his death held the title of Geheimer Oberregierungsrat. He had also received the decorations of the Red Eagle IV and the Prussian Crown III, besides other honorary decorations from Holland, Norway, Sweden, and Denmark. He was president of the German Congress for Testing Technical Materials and vice-president of the International Congress. Though of a strong and even dominating personality, Martens possessed a warm-hearted democracy that endeared him to all who enjoyed his personal acquaintance.

Towing Artillery by Motor Car

IT is said that artillery is the most potent factor in winning battles, and in view of this fact a recent experiment made in England is of interest. A horse battery weighing thirty-three hundredweight was attached behind a motor car, towed seventy-five miles and made ready for action in less than five hours, a feat that would have required thirteen or fourteen hours if rail transportation had been depended upon. Besides the towing ability of the automobile, the questions of braking on steep hills and whether the gun mounting and wheels as at present constructed would stand the strain, were involved, and these appear to have been satisfactorily answered. As a result of the experiment it is suggested that automobile manufacturers be subsidized by the government to keep always available a certain number of suitable chassis for gun transportation, which would undoubtedly have the effect that no successful hostile raids would be possible. The result of this experiment, if adopted, means that at short notice such an enormous superiority in artillery could be concentrated at any given point on the coast as to make it almost out of the question for a raiding force to move from under the shelter of the guns of its escorting warships, supposing them still to be present; and as the whole object of a raid—which is quite a different thing from invasion in force—is speed in arriving at its objective before sufficient force can be concentrated to deal with the raiders, it is obvious that the game ceases to be worth the candle.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

How to Secure the Promotion of the Most Efficient Naval Officers

To the Editor of the SCIENTIFIC AMERICAN

Permit me to set down very briefly an alternative plan for the promotion of officers, a plan which I think is superior to that recently advocated by you.

Certainly the highest ranks should be held by selected officers. Accurate selection can be made only by officers themselves from among themselves. As a rule, admitting exceptions, officers know thoroughly only their neighbors on the list, those about two years on each side, some younger and some older. Age, health and physical vigor, character, intellectuality, temperament, and, above all, character, must be the determining qualifications. It is so desirable as to be deemed essential that, in the flag ranks, officers should have at least a minimum of five, six, or seven years to serve before arriving at retiring age; and that can never be if we adhere to strict seniority promotion. (I confine attention just now to flag rank only, simply for brevity in explaining the plan that I shall propose to you.)

Suppose that next year there are to be five promotions to flag grade. Very well, let those five be chosen by the senior twenty captains from among themselves, and let the remaining fifteen, as a result of their own action, pass to the retired list, with the rank, but not the pay, of rear admirals. I say "with the rank" because I think that just recognition should be made of the value of the service performed by them in doing what they alone could have done so well, namely, choosing the best for advancement. And "but not the pay," because any pecuniary reward would somehow tarnish their action.

Now just consider some of the effects of the plan as thus proposed. The very best selections will be made. The officers advanced would get their higher rank with a great addition of honor and a deep feeling of grateful pride and solemn responsibility. The officers retired by their own act would, so it seems to me, leave the active service with no feeling of humiliation or heart-burning, glad to have been able to lift young and competent men to high place. "In honor preferring one another" is no light or idle phrase.

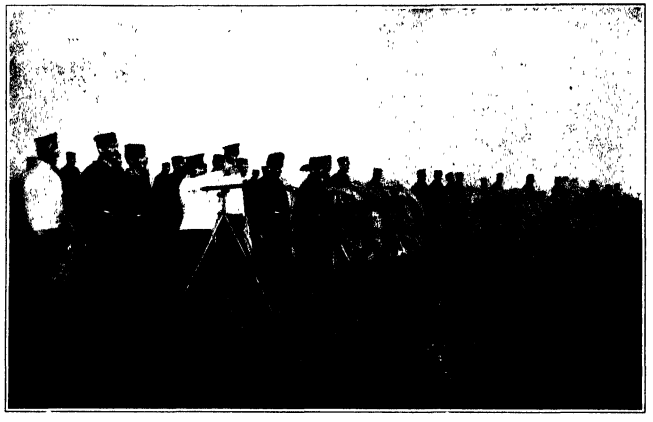
I know that the present plucking system has a very depressing effect far down the line, tending to diminish the attraction of the service, while death itself would be preferable to the officer plucked.

So admirably do they illustrate the principle of selection as described above that I venture to quote some of the regulations concerning the bestowal of the Victoria Cross:

". . . . It is ordained that, in the event of a gallant and daring act having been performed by a squadron, ship's company, a detached body of seamen and marines not under fifty in number, or by a brigade, regiment, troop, or company, in which the admiral, general, or other officer commanding such forces may deem that all are equally brave and distinguished, and that no special selection can be made by them; then, in such case the admiral, general, or other officer commanding, may direct that for any such body of seamen or marines, or for every troop or company of soldiers, one officer shall be selected by the officers engaged for the decoration, and in like manner one petty officer or non commissioned officer shall be selected by the petty officers and non-commissioned officers engaged; and two seamen or private soldiers or marines shall be selected by the seamen, or private soldiers, or marines engaged respectively, for the decoration; and the names of those selected shall be transmitted by the senior officer in command of the naval force, brigade, regiment, troop, or company to the admiral or general officer commanding, who shall in due manner confer the decoration as if the acts were done under his own eye."

Washington, D. C. EFFICIENCY

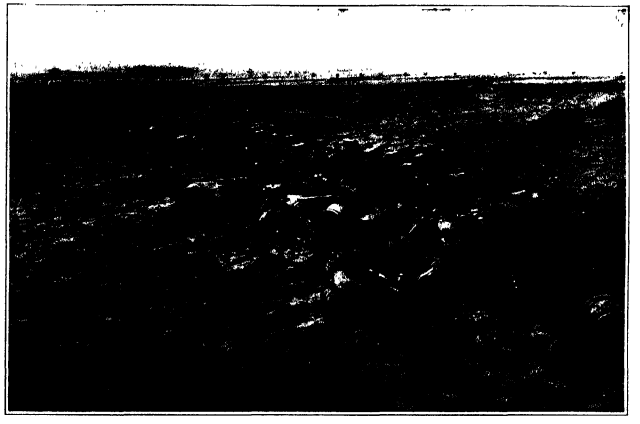
The Fertilizing Qualities of Tropical Rainfall are probably not realized by most students of agriculture. Nitric acid is formed in the atmosphere by lightning discharges and is most abundant in regions where thunderstorms are of frequent occurrence. In the *Annales de Géographie* M. Guillaume Capus discusses the results of chemical analyses of rain-water made in French Indo-China, and bases thereon an estimate of the total value of the fertilizing substances brought to the soil by rain over a great rice-growing region. In the thirteen provinces constituting the Tonkin delta he estimates that the amount of atmospheric nitrogen thus annually obtained is equivalent to 181,390 tons of nitrate of soda, and 137,510 tons of sulphate of ammonia, worth $19,822,000.



Servian field artillery.



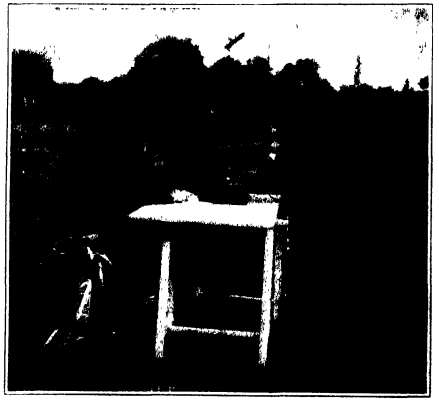
How the light French machine guns in a mountain battery are transported.



German infantry firing from trenches.



Count von Moltke; the German Emperor; Count von Zeppelin; Excellenz von Scholl.



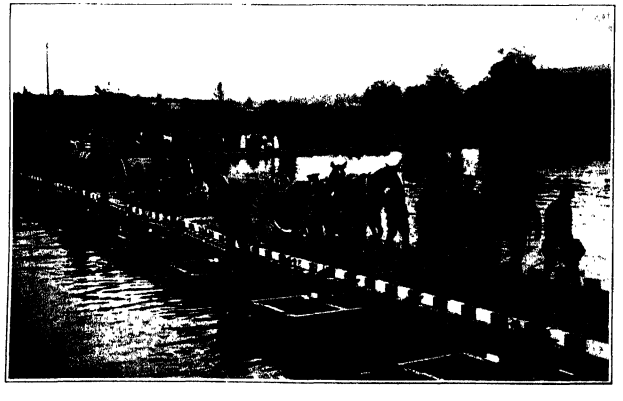
A French military wireless station.



Traveling kitchen of the 131st French infantry.



German infantry on the march.



An English pontoon bridge for the crossing of streams.



A German covered battery [illegible]sked observing position.



A new form of field oven used by the British. The meal is cooked by the time camp is reached.

THE EUROPEAN [illegible]S IN ACTION

The Heavens in September

New Information About the Brilliant and Massive Stars of Scorpio

By Henry Norris Russell, Ph.D.

BEFORE the brilliant summer constellations disappear on the southwestern horizon, we may look with especial interest upon Scorpio, in the light of an admirable investigation by Prof. Kapteyn, which has just appeared. This distinguished astronomer has been engaged for a long time in a thorough study of the motions of the stars, and has of late been devoting special attention to that remarkable class which show in their spectra the dark lines of helium. These stars are the whitest of all in the heavens, and probably the hottest; they are of enormous real brightness, and are remarkable, too, because they are moving much more slowly in space than are most of the other stars, so that the greater part of their apparent motion in the skies arises from the Sun's own motion past them through space.

It has been known for some time that a number of these stars, especially those in Scorpio and the neighboring constellation Centaurus, were apparently moving in almost parallel directions, and probably formed a group, in motion together through space. A diagram showing this motion was printed in these columns some time ago, and is here reproduced.

Prof. Kapteyn, who was one of the first, if not the first, of all to recognize this fact, has made an exhaustive study of the motions of the "helium stars" in this and other regions of the sky, and has obtained conclusive evidence that almost the whole of the stars of this type in a huge region of the sky, 60 degrees wide and 140 degrees long, extending for 30 degrees on each side of the Milky Way from Argo past the Southern Cross and Centaurus to Scorpio and Ophiuchus, are moving together, relatively to the Sun, at least. If allowance is made for the Sun's motion, they must be almost at rest relative to the general average of the stars, but as seen from our own moving system, they all appear to be drifting toward the same point in the heavens, which lies about 5 degrees northwest of the bright star Vega. The apparent rate of motion is usually very low, averaging not more than 4 seconds per century, or 1 degree in 90,000 years; but the accurate computations contained in Prof. Boss's great catalogue determine even these small motions with very considerable precision.

Spectroscopic measures of radial velocity, which have been made for many of these stars, show that the actual rate of their motion is fairly rapid—18 kilometers, or 11½ miles, per second. When this has been determined, the actual distance of each individual star which belongs to the group can be computed by simple formulæ. In this way Prof. Kapteyn has succeeded in determining the actual distances of 226 of these stars. Owing to the small errors of observation, and the fact that the stars, though moving very nearly in parallel lines and at the same rate, are not exactly doing so, the deduced distances may be, on the average, as much as 25 per cent in error; but this is very satisfactory, for there are not very many, even of the nearer stars, whose distances are known more precisely than this, and the stars here considered are so far off that there is no other way of finding their distances, even roughly. Only one of the lot is within 100 light-years of the Sun. The majority lie between 180 and 400 light-years; but some are probably as much as 1,000 light-years away, and even more.

All the brighter stars but one in the northern part of Scorpio belong to this great group, the exception, π Scorpii, being a star of large proper-motion which is presumably very much nearer us than the others. The conspicuously red Antares, though quite unlike the others in spectrum, agrees with them so closely in the amount and direction of its motion that there can be no doubt it belongs to the group.

The distances and real brightness of the fifteen brightest stars of the group in this region are given in the table herewith, arranged in order of their apparent brightness. All these stars are marked on the accompanying map of the heavens except ω_2 Scorpii, which is the uppermost of a pair of faint stars just below β. μ Scorpii is a fine naked-eye double—not easily seen in our latitudes, because it is so near the horizon, and both its components belong to the group.

The most remarkable thing about these stars is their enormous luminosity. The faintest of them, which are not very conspicuous to the unaided eye, send out two or three hundred times as much light as the Sun, while Antares is the brightest object that is so far definitely known, though Prof. Kapteyn finds that β Centauri is almost equal to it (some 3,000 times as bright as the Sun). It is not improbable that some of the stars whose distances cannot yet be estimated, like Regel and Canopus, are even brighter.

It is a very natural thing to ask, Why should these



Proper motions of stars in Scorpius and Sagittarius in one hundred thousand years.

stars be so exceedingly bright? Several causes probably combine to bring this about. In the first place, these stars are unusually massive. Several of them are spectroscopic binaries, and their masses can be determined, though observations have so far been completed only upon two. The combined mass of the pair of stars which form β Scorpii is many times greater than that of the Sun, while in the case of μ Scorpii it is also very much larger. But this alone will not account for their brightness. A pair of stars, each of ten times the Sun's mass, but similar to the Sun in density and giving out the same amount of light per square mile as the Sun does, would together emit only nine times the Sun's light, which is far too small an amount. But judging from the analogy of other stars of similar spectrum, we may expect such pronounced helium stars as those which we are considering (except Antares) to be of less than one tenth the Sun's density, perhaps as little as one fiftieth. A pair of stars of density between these limits, and each of ten times the Sun's mass, would have a combined surface area somewhere between 40 and 125 times that of the Sun. To send out as much light as the brighter stars in Scorpio do, they would have, even so, to emit more than ten times as much light per square mile as the Sun does. But this is quite reasonable to believe; in fact, the best available estimates of their temperature lead to the belief that their surface brightness must be about twenty times the Sun's.

Star.		Magnitude.	Distance, Light Years.	Real Brightness, the Sun's being taken as 1.
α Scorpii	(Antares)	1.2	390	3600
λ	"	1.7	365	1200
κ	"	2.5	510	1000
δ	"	2.5	305	370
υ	"	2.8	310	300
β	"	2.9	365	600
τ	"	2.9	330	550
π	"	3.0	330	500
σ	"	3.1	380	910
μ_1	"	3.1	440	900
μ_2	"	3.6	400	490
ρ	"	4.0	410	310
ω_2	"	4.1	395	240
ν	"	4.3	370	200
ϕ	Ophiuchi	3.4	420	600

It seems therefore very probable that the great luminosity of these stars arises from the co-operating influences of great mass, low density, and high temperature. If, among the numerous spectroscopic binaries of this group, some are found to be eclipsing pairs, as is very probable, the exact contributions arising from each of these three factors can be determined, and we will know more about these stars than any others.

The above remarks do not apply to Antares, which is a fiery red star, and, by all the signs, must be much colder than the Sun, and give out less light per square mile. All the evidence indicates that it would be a high estimate to assume that the surface-brightness of such a star was one tenth that of the Sun. If this is the case, Antares must have some 34,000 times the Sun's superficial area, which would make it more than 180 times as big as the Sun, or 160 million miles in diameter, and nearly as big as the whole orbit of the Earth. This is a remarkable conclusion, but appears to be clearly indicated by the facts. There is good reason to suppose that the mass of Antares is not correspondingly great; in fact, not much, if at all, greater than that of the other stars in Scorpio; so that the density of this great red star is in all probability excessively low.



At 11 o'clock: Aug. 7.
At 10½ o'clock: Aug. 14.
At 10 o'clock: Aug. 22.
At 9½ o'clock: Sept. 6.
At 9 o'clock: Sept. 14.
At 8½ o'clock: Sept. 21.
At 9¼ o'clock: August 29.

NIGHT SKY: AUGUST AND SEPTEMBER

The Heavens.

Our map has been chosen to show the early evening skies, in order to exhibit the whole of Scorpio, which is just shining in the southwest. East of it is Sagittarius, and then Capricornus, now brightened by the presence of Jupiter. Then comes Aquarius, a very dull constellation, and below this the Southern Fish, with its one bright star, Fomalhaut. The great square of Pegasus is well up in the east, and Andromeda and Perseus are in the northeast. Cassiopeia and Cepheus are above the latter; then comes Cygnus, right overhead, and Lyra and Aquila to the west and south. Ophiuchus and Serpens are in the southwest, and Hercules, Corona, and Boötes in the west. The Great Bear is low on the horizon, just west of north, and the Little Bear and the Dragon are above it.

The Planets.

Mercury is an evening star all through September, but is poorly placed for observation, being south of the Sun and at a rather small elongation, and can only be seen just after sunset at the end of the month. Venus is evening star, and is at her greatest elongation, 46 degrees 27 minutes east of the Sun, on the 18th; but she, too, is far south, and so is less conspicuous than usual, setting between 7:30 and 8 P. M.

Mars is evening star, too, but is farther west than Venus, and sets earlier—about 7:20 P. M.—in the middle of the month, so that he has become practically invisible.

Jupiter is in Capricornus, just past opposition, and well placed in the evening sky, of which he is the most conspicuous ornament.

Saturn is coming out into the morning sky. He is in

(Continued on page 163.)

Remarkable Wood Preservation

By S. F. Marvell

There is at La Brea, near Los Angeles, Cal., a spot of extraordinary scientific value. It is an asphalt deposit from which bones of prehistoric animals have been taken by the ton, among them the skeleton of a mammoth supposed to be 200,000 years old. The asphalt pit was apparently once a fissure filled with viscid oil or bitumen. Animals that ventured upon it sank and perished. The place is full of bones, skeletons of camels, horses, sloths, wolves, bisons. It is believed that most of these animals belonged in the Pleistocene period, immediately preceding the modern, and that they lived some 300,000 years ago.

A log of wood with bark still on it was found standing upright among the bones. How it happened to reach that place and attain that posture is a matter for speculation. The bark is rough and stringy, but fails to shreds when the asphalt is dissolved out with gasoline. The wood is quite dark. The color does not seem to be due to the asphalt, because when a gramme of chips is soaked in a few cubic centimeters of gasoline for a day or so, little color is imparted to the liquid. Neither does the wood respond to tests for tannin. Although brittle and hard to cut in thin cross-sections, the wood does not differ materially in hardness from other soft woods.

The tree was of very slow growth. Each annual ring is about three tenths of a millimeter broad, and there are from eleven to fifteen rows of wood cells to the ring. The resin ducts may be plainly seen with globules of resin in them. The state of the wood's preservation is wonderful. The delicate cells, even down to their bordered pits and tori, are all in place and unbroken, though apparently slightly compressed. Under the microscope the wood looks as fresh as a sample newly cut from a living tree, except that the grains of starch or other substance in the medullary rays are slightly shriveled, and threads of fungus are visible. The wood appears to be one of the junipers.

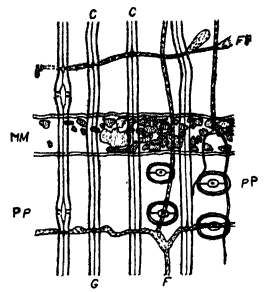
The tree was evidently dead before it went into the asphalt. The presence of the fungus is the proof of this. There are many fine threads, or mycelia, not more than twelve ten-thousandths of a millimeter in diameter, ramifying through the wood, lengthwise with the wood cells and also penetrating their lateral walls. Some of these threads are a centimeter long. The position of the fungus indicates that its activities were suddenly ended. That doubtless occurred when air was excluded by the log's immersion in the plastic asphalt. Everything remains as it was at the last minute. Many of the mycelium tips appear just in the act of piercing a cell wall. Here and there are branches just budding from a main thread. It reminds one of the fate of Pompeii—the suddenness with which life was blotted out. *Substitute a colony of fungus in a log of wood* for a city full of men; a pool of oil for hot ashes; and the similitude is complete.

Oil is evidently an excellent preservative. During two thousand centuries that tree lay buried in asphalt, and it comes out as well preserved as it was the day it went in. The wood's examination was made with a power of 300 diameters on an ordinary microscope. The wood sections were cut from points within two centimeters of the bark.



Longitudinal section of La Brea wood, showing cells, pits, fungus, medullary rays, resin duct, etc.

Made with 300 diameters.



Longitudinal section, showing four cell walls, a medullary ray, fungus threads, and pits.

C, Cell walls, *F*, fungus threads, *M*, medullary ray, *P*, pits

A Double-piston Internal-combustion Engine

THE idea of the double-piston engine is not new. It dates back to Bodmer, who in 1834 invented a steam engine with two pistons that operated toward and from each other in a single cylinder. The principal drawback to this construction was found to lie in the stuffing boxes. However, this drawback does not apply to the single-acting internal-combustion engine, and we find in the accompanying illustration an engine of this type with two cylinders, each fitted with double pistons. The advantages claimed for this novel engine are that it obviates certain difficulties of heat radiation common to the ordinary internal combustion engine, that the weight per horse-power is decreased, and that it does away with useless forces and negative work.

For the purposes of identification we have lettered the pistons, in the nearer cylinder *A* and *B*, respectively, and the pistons in the farther cylinder *C* and *D*. The piston *A* is fitted with a crosshead from which a pair of rods run down obliquely to a pair of crossheads carried by the piston *D*. In like manner pistons *B* and *C* are connected by a pair of oblique rods. The engine is of the two-cycle type. In the position illustrated the explosive mixture is entering the farther cylinder through an intake port that has just been uncovered by the piston *C* and is displacing the products of combustion which pour out of the exhaust port that has been uncovered by the piston *D*. In the meantime the charge in the adjoining cylinder has been compressed, and on ignition it will force the pistons *A* and *B* apart. The piston *B* acts directly on the crank-shaft, while the piston *A* also acts on the crank-shaft, but through the intervention of piston *D*. As the pistons *A* and *B* move apart, the pistons *C* and *D* are pulled together by the rod connections, compressing the charge between them.

The chief mechanical drawback to this construction lies in the obliquity of the connecting rods which produces a horizontal thrust on the crosshead slides. However, the thrust of the two sets of rods is equal and opposite, preserving a balance that prevents vibration. One of the principal mechanical advantages of the construction lies in the fact that the work of compressing the charge is not performed through the crank and connecting rod, but directly through the oblique rods, and only useful work is transmitted to the crank-shaft. The center of gravity of pistons *A* and *D* travels vertically in the plane *Q P*, while the center of gravity of the other pair travels in identically the same plane, but in the opposite direction, so that the two motions are perfectly balanced.



Gas engine with double opposed pistons.

The advantages of this engine from the point of view of heat are quite obvious. The cylinders consist of two water-jacketed tubes open at each end. As there are no cylinder heads, each tube is free to expand symmetrically, and as there are no corners or pockets, the mean temperature of the inner surface of the cylinders is very low.

In a new construction of this engine, wherein eight two-stroke pistons are combined with four cranks, the weight for a given power is from one half to one third of that required in other constructions. A 500 horse-power engine of this type was recently put to a test. It weighed without flywheel under 20 tons, and gave some 550 horse-power continuously. An ordinary gas engine of equal power would weigh twice as much. This result was obtained with four cylinders, 12 inches in diameter, at a moderate piston speed of 750 feet per minute, and a low mean effective pressure of under 70 pounds per square inch. Despite the makeshift character of the auxiliaries for supplying the engine with air and gas, it showed an overall efficiency during a 30-hour test of just under 30 per cent, while the indicated efficiency was 37.6 per cent. The mechanical efficiency of the engine itself was about 90 per cent.

Welding Malleable Castings

WHILE the process of autogenous welding is being used so successfully in all the metal trades, many unsuccessful attempts have been made to weld malleable cast iron, and to those who have experienced disappointment, an explanation that recently appeared in the *Iron Age* of why their efforts failed, with an outline of a method by which these castings can be mended, should be of benefit.

Malleable castings are originally in the condition of hard, brittle, white cast iron that is subsequently made malleable by heat treatment, which effects a chemical change in the structure by decarbonization. This decarbonization is nearly complete at the surface, but in a lessening degree toward the center, giving the outside portion the texture of mild steel while the inner portion may retain the qualities of cast iron. It is useless, therefore, to follow the welding method prescribed for either material.

To mend successfully a malleable casting the welding material should *fuse at a lower temperature than* the casting, and its adherence, bonding qualities, physical strength, and ductility should closely resemble the original casting.

In preparing the work, the fracture is chipped away in the form of a V groove, and the part surrounding the fracture is then heated with an oxy-acetylene torch to a bright red, and sprinkled with a bronze flux, followed by a few drops of Tobin bronze melted from the welding rod. If the bronze remains in a little globule the work is not hot enough, but if it spreads and adheres to the surface, the temperature is right, and the groove should be quickly filled, and at as low a temperature as possible. The behavior of the bronze affords a guide in regulating the temperature. This process cannot be called autogenous welding, but a malleable casting mended in this way is practically as good as one piece. It has about the same tensile strength and ductility as the original, and the process has the advantage of being very quickly performed.

Household Industries in the Philippines

THE scheme of increasing the earning capacity of the Filipinos of the lower classes by training the women in various household industries has made excellent progress. At one time it appeared doubtful whether the average standard of intelligence among these women was high enough to enable them to take up lace making, fine embroidery, and the like, with success. However, this question has been fully tested in the women's department at Bilibid Prison, where industrial instruction was recently inaugurated by Miss McGee. The female convicts were generally of low intelligence and untrained in the use of a needle, yet within four months a number of them qualified as efficient workers, and not one failed to develop the efficiency necessary to produce a marketable product representing at least a fair daily wage. Now a school of household industries has been established at Manila, providing for the instruction of about 300 women a year. The pupils are under obligation to return to their homes scattered over the islands, at the end of the course of instruction, and to instruct the women of their communities in the same industries.

The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

Driving All Four Wheels

By Ross Babcock, M.E.

THE efficiency of a commercial motor vehicle depends to an appreciable extent upon the tractive effort it can develop, and this is particularly the case with the heavy vehicles now so generally in use. For years the typical pleasure vehicle has been driven from the rear wheels, the front wheels performing only the function of steering the car except in so far as they support part of the weight.

This method of construction may be looked upon as a natural one; it follows the line of least resistance and solves the problem of propulsion and steering with the least complication and without engineering difficulty not easily overcome And inasmuch as the development of commercial motor vehicles came after the development of vehicles intended largely for the pleasure of those who own them, it may be looked upon as natural that their construction follows closely the construction of their predecessors. Nine tenths of all the commercial motor vehicles produced are propelled through the rear wheels and steered only through the front wheels.

But with the loading of such vehicles to the extent that is now common, other difficulties than those of merely propelling and steering the vehicle came to light. For instance, it was discovered that for real efficiency it is essential properly to proportion the amount of weight carried by the four wheels. Where but two wheels are used to propel the vehicle this necessitates that the greater part of the load is centered over them in order to obtain the necessary traction.

Again, when the greater part of the load is centered over one pair of wheels, which is usually the rear pair, that part of the mechanism, unless constructed of proportionately stronger parts, is called upon to sustain excessive strains.

The advantages of the four-wheel drive vehicle over the vehicle in which only two wheels are driven are given as follows:

1 Tire economy.
2 More equal distribution of wear on mechanical parts.
3. Increased traction.
4. More equable power distribution.

Against these advantages must be balanced:

1. Engineering difficulties to be overcome.
2 Increased complexity of machinery
3 Possible increase in maintenance cost (see No. 2)
4. Possible increase in care needed during life (see No. 2).

Taking up the advantages one at a time we find upon purely superficial examination that tire economy comes naturally by reason of the fact that the load and the driving wear are taken in proper proportion by all four wheels

The wear upon mechanical parts is equalized to a greater extent when all four wheels do their share of the driving and load carrying than is the case where but two of the wheels both drive and support the bulk of the load.

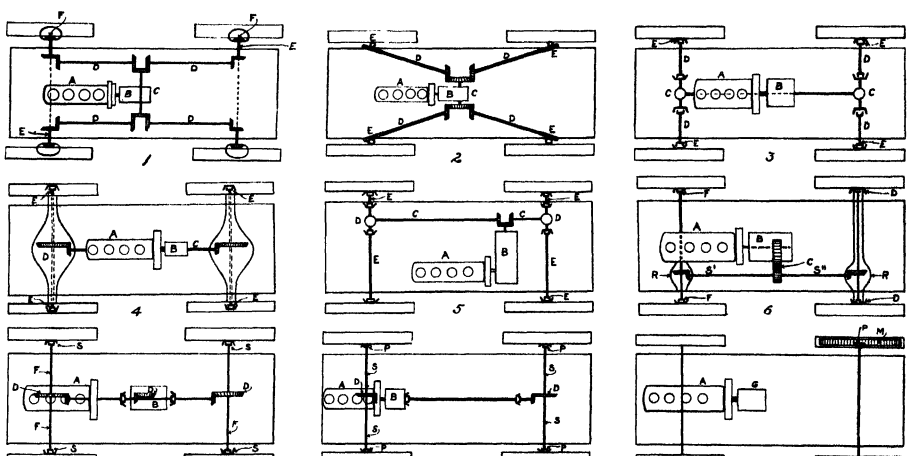
The question of increased traction scarcely requires any enlarged discussion. In this respect, the heavy towing locomotive forms a homely analogy. Here all the available weight is placed over the driving wheels, and the number of these wheels is made as great as possible. The same holds good of the four-wheel drive truck, except that in this case the idea is carried still further; for in it all of the weight is centered over all the wheels and all the wheels drive.

The distribution of the power of the engine to all four wheels instead of merely to two of them appears to be quite logical, for whereas the driving wheels of an ordinary vehicle often are severely overtaxed by carrying both the dead load and the driving load, the front wheels, which carry but a fraction of the load, must under most ordinary conditions be undertaxed, if such a word may be used.

Under the head of disadvantages, the engineering difficulties which must be overcome, loom fairly large; here we have the problem of driving four wheels instead of two, and this may or may not necessitate the addition of some means of permitting a certain amount of flexibility between the relative speeds, not only of each of a pair of wheels, but between each pair of wheels complete. Nor is the ordinary type of differential mechanism entirely satisfactory.

Added to this we have the difficulty of providing some means of both driving and steering one of the pairs of driven wheels. This requires some sort of a universal joint or similar mechanism, which, of course, means increased friction and added wear and power consumption. The solution of the problem, of course, renders simple, or comparatively so, the steering of all four wheels as well as the driving of them, and this has a decided advantage where the vehicle is to be used in considerably congested traffic or in close quarters.

The other disadvantages may be grouped for they all hinge upon the increased complexity of the mechanical construction of the vehicle There can be no doubt but that there are more wearing parts in a four-wheel drive than in a two-wheel drive vehicle.



Mechanical arrangement of typical American and foreign four-wheel drive trucks.

The accompanying diagrams show how all of the most prominent American and foreign motor vehicle builders have gone about solving the problem of driving all four wheels.

Figs. 1 to 5, inclusive, show five of the methods of construction used by the recent contestants in the French military trials, and hence may be regarded as thoroughly representative of foreign practice.

In Fig. 1, which shows the Chatillon-Panhard, power is transmitted from the motor *A* through a gear set *B* and a single central differential *C* to the lateral shafts *D* through bevel gears and thence to auxiliary shafts *E* through bevel gears to vertical shafts *F*, and finally to the wheels through more bevel gears.

Fig. 2 shows another type of Chatillon-Panhard drive in which the arrangement is somewhat similar except that final drive from the radiating shafts *D* is by worm gears to the wheels.

Fig. 3 shows the method used in the Bium-Latil vehicles. In this case the power is transmitted from the motor *A* through a gear set *B* to "live" axles both front and rear, incorporating each its own differential *C*. Thence, the drive is taken by shaft *D* through universal joints to reducing pinions at the wheel hubs.

In Fig. 4 is illustrated the method of drive employed in the heavy Renault vehicles. Here, power is transmitted from the motor *A* through a gear set *B*, and thence by shaft *C* to "live" axles in each of which is incorporated a differential. At *E* there are universal joints at the sides of the pivot pins of each of the wheels.

In Fig. 5, which shows the Schneider arrangement, the method is quite different. In this case the motor *A* is set well to one side of the chassis and the gear set *B* is located transversely. From the gear set power is transmitted through bevel pinions to the longitudinal shafts *C*, and thence through "live" axles, each with its differentials, to the wheel shafts; numerous universal joints are used to permit the necessary flexibility.

The arrangement which is shown in Fig. 6, and which represents a typical American design, is quite different. Here, there are two longitudinal shafts *S'* and *S''*, which drive through differentials *R* and wheel shafts to universal joints. From the motor *A* the power is transmitted through a gear set *B*, and thence by means of a "silent" chain to the longitudinal shafts *S' S''*.

In Fig 7, the arrangement is somewhat similar except that the chain is eliminated. Power is transmitted from the motor *A* through a gear set *B* incorporating a differential *D*, and thence to "live" axles incorporating other differentials; there are three altogether. The "live" shafts are designated *F* and the wheel pinions *S*. These are universal joints.

Fig. 8 shows another typical American design that does not differ materially from the others. In this case the motor *A* is located well forward on the chassis and drives through a gear set *B* to differentials *D* on both front and rear wheel shafts *S* through suitable universal joints. The final drive to the wheels is through

(Concluded on page 154.)

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RECENTLY PATENTED INVENTIONS

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Pertaining to Apparel.

COMBINED SUSPENDER TAB AND BELT LOOP FOR TROUSERS.—A. Leighton, Erie, Pa. The purpose here is to provide a flexible tab, the lower portion of which is secured to the inside of the waistband, and the upper portion of which is adapted to be turned down upon the outside of the waistband, this latter portion of the tab and trousers being provided with co-operating fastening means whereby to secure the tab in turned down position in such manner as to form a belt loop.

KNITTED COLLAR FOR VESTS AND COATS.—F. G. Curtis, care of J. H. Rice & Friedman Co., Milwaukee, Wis. The general objects of this invention are to provide a knitted collar for garments to which it is knitted in a suitable manner, so that the collar will have the proper set when turned down, yet snugly fit around the neck when turned up, the front ends of the collar being provided with a snap fastener so as to closely fit the front of the neck when turned up.

Pertaining to Aviation.

BIPLANE.—E. W. F. Herrmann, 1200 Hays St., San Antonio, Tex. The principal object of the inventor is to provide a flying machine having a relatively high degree of stability and effective supporting surfaces proportionate to the relative small area of the supporting planes. Further, to dispose a pair of propellers in such position as to give the greatest lifting effect to the machine, and to so dispose the propellers as to obtain the greatest efficiency.

Of General Interest.

HOLDER AND STERILIZER FOR DENTAL BURS.—H. J. Fries, 1002 N. J. St., Tacoma, Wash. This invention comprises two principal but intimately related parts, namely, a holder proper for burs or drills kept in stock, and a combined tray, or holder, and sterilizer for such burs or drills as the dentist may require for immediate use.

GREASE CUP.—T. O. Organ, 116 W. Seymour St., Germantown, Pa. This cup employs a plunger to discharge the grease, and is so constructed that a rigid stem or shank of minimum length may be formed between the cup and the part to be lubricated, thus greatly reducing or overcoming the liability of breakage under centrifugal force.

Hardware and Tools.

NUT LOCK.—J. G. Schneider, York, Pa. Address Charles A. Hawkins, 42 W. Market St., same place. This invention is embodied in a jam or locking nut having a body formed of a soft metal material such as cast iron, and inclosing casing of thin sheet metal, both of which are compressed into conical form engaging the thread of the bolt to which the main nut is applied.

HAMMER.—J. F. Overcash, Primghar, Iowa. This power hammer is capable of use with the ordinary blacksmith's anvil, wherein mechanism is provided for controlling the power of the blow, and for controlling the movement of the hammer, so that the blow may be delivered upon any part of the work

Heating and Lighting.

DRILLING BIT.—J. E. Prosser, Address Edwin R. Perry, Tulsa, Okla. The purpose here is to provide a bit especially adapted for use in drilling deep wells, wherein the bit is provided with water courses which are adapted to be connected to the cutting end in spiral form. When dull, the cutting edge may be sharpened in the usual manner

PIPE TONGS.—J. De W. Meredith, care of Petrolia Machine Shop, Petrolia, Texarkana, Tex. This tool is especially adapted for use with vertically arranged pipes, wherein flexible clasping mechanism is provided, capable of being quickly arranged to encircle the pipe or to release the same, and having gripping mechanism to engage the pipe evenly and uniformly.

DAMPER.—G. Wolf, 419 E. 22nd St., New York, N. Y. This invention provides a very minute regulation of draft in the combustion chamber of a furnace, steam boiler, heater, or stove, so as to insure a proper combustion by a mingling of the oxygen of the atmospheric air with the combustible gases before the latter escape through the smoke pipe and flue, and at the same time permitting the escape of non-combustible gases and preventing the same from being discharged into the rooms or building being heated, and thereby avoiding the casualties and odors which otherwise result.

THERMOSTATIC PRESSURE VALVE.—M. Lewless, care of J. J. McGovern, 277 Moffatt St., Brooklyn, N. Y. This valve is adapted for particular use in connection with a portable radiator heater, although the valve may be designed for use with other heating systems or storage devices wherein it is preferable or necessary automatically to cut off a supply of fluid matter, or, to cut off the supply of fuel to a burner for the heater.

Household Appliances.

STOVE TOP SUPPORT.—G. R. Heinemann and A. Oehnemus, Quincy, Ill. Address Excelsior Stove Mfg. Co., same place. The main object here is to provide a support having a base provided with a socket to receive the support, said socket permitting the shifting of the position of the support, thereby permitting it to enter farther into the socket so as to lower the top of the support while holding the same firmly locked in its shifted position

Machines and Mechanical Devices.

PLATEN ROLLER RELEASE.—R. M. Mosher, Dillon, Mont. This invention provides releasing mechanism for enabling the operator to release the platen roller, or in other words, to render it free from the mechanism ordinarily used for actuating it, thus enabling the platen roller to be turned in either of two directions, independently of the mechanism for actuating it during the general operation of the typewriting machine

AUTOMATIC MULTIPLE CHUCK DRILL PRESS.—J. N. Landau, 101 W 117th St., New York, N. Y. In this chuck drill press either of the chucks or tool-holding devices may be brought into successive coupling position to be rotated or operated from a single working spindle, the improvement being designed to be applied to machines which are now generally constructed, or to a machine having a specially mounted and driven spindle

Railways and Their Accessories.

CAR WHEEL.—J. Slattery, 58 Chrome St., Chrome, N. J. The object in this case is to provide an improved wheel structure wherein a solid center is presented and a wearing rim connected with the periphery thereof. Another object is to provide a wheel in which is presented a locking member for the wearing rim or tire, whereby the parts are rigidly connected together.

Prime Movers and Their Accessories.

TIDE MOTOR.—J. Ishii, 69 Westland Ave., Boston, Mass. The invention relates to tide motors, and the object is to provide certain improvements in devices of this character both with respect to the float and the controlling means and the mechanism whereby to transmit and store the power generated by the rise and fall of the float.

MULTICYLINDER INTERNAL COMBUSTION ENGINE.—S. H. Hart, 41 Maiden Lane, New York, N. Y. Among the objects in view in this patent are, to construct a water jacket for engines as a single or block casting irrespective of the number of cylinders, to permit the use of classes of metals for the cylinders and jacket; to provide a packing for the joint between the cylinder and jacket to prevent dislodgment of the packing by shock of explosion; and to provide a separable head for said jacket and cylinder for securement upon said jacket to lock the cylinder therein

GRINDING TOOL FOR GAS ENGINE VALVES.—C. L. Baldwin, care of M. Casey Almond, Wis. An object of this inventor is to provide a hand tool having a valve-engaging head connecting with a stem or shaft to which rotation is imparted by one hand of the operator through suitable means, while pressure is exerted through the tool on the valve by the other hand so as to hold the valve in grinding relation to its seat

Pertaining to Vehicles.

TOOL FOR REPAIRING TIRES.—P. E. Ericsson, Port Chester, N. Y. This invention relates to tools or appliances for repairing pneumatic tires and has particular reference to such tools, having the capability of ease and reliable manipulation for insertion and for inserting their being held securely in proper position during the treatment of the tires

SLED BRAKE.—C. W. Foote, Rochester, Mich. This brake will engage the snow under the runners of the sled and thus prevent the forward movement thereof. The brake is normally suspended on the sled in such position that it will be above the level of the snow, and so arranged that it can be controlled by the person on top of the load, and allowed to move downward beneath the runners to give the desired result.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper

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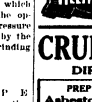


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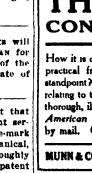


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Scientific American Supplement No. 1713—*Brazing Cast Iron and Other Metals*, gives detailed instructions for the whole operation and formulas.

Scientific American Supplement No. 1644—*Soldering and Soldering Processes*, gives broad general information, and contains in particular a method for pulverizing solders and alloys of great use.

Scientific American Supplement No. 1667 *Some Soldering Appliances*, describes the blow-pipe and the furnace in their various forms.

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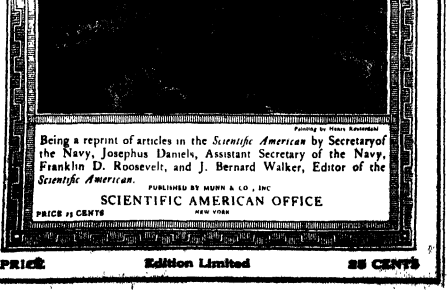
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Painting by Henry Reuterdahl

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Driving All Four Wheels

(Concluded from page 155.)

universal joints and spur gears *F*.

Obviously, the use of electricity renders comparatively simple the application of the drive to all four wheels, and it is perhaps surprising that a greater number of makers have not taken this construction up. Fig. 9 shows what is probably the most successful of the very few electric four-wheel drive vehicles there are on the American market.

In this case the motor *A* is direct connected to a small electric generator *S*. This generator in turn is connected through a suitable controller with motors which are incorporated in each of the wheels of the truck. In this respect, it should be emphasized, that in this particular system, the motors are directly within the wheels of which they form an integral part.

Motor Truck Notes and Queries

E. P. O. writes: "While traveling through a certain section of the South recently, I observed several heavy trucks at work on a large excavation. They seemed to be provided with a special type of broad, flat wheels that enabled them to work in a soft surface with the greatest of ease. I would like to know more of the details of these trucks."

A. So far as the power plant, transmission, and frame are concerned, these trucks of which you speak were of the same kind that you will notice frequently on the streets of any large city. The ordinary wheels with their rubber tires, however, had been replaced by the special type of broad-rimmed tractor wheels, similar in principle to those used on the steam traction engines, although much smaller because of the high speed at which the gasoline engine does its work the most efficiently. These trucks that you saw were virtually then gasoline tractors, and they are used on many of the large farms for plowing, harrowing, and other agricultural operations. When desired, transverse flanges may be placed on the rims of the wheels to enable the truck to secure better traction on slippery road surfaces when it is hauling a heavy load distributed in three or four trailers. We believe that the type of tractor that you saw at work in the excavation is also provided with a power winch that is operated by the gasoline motor. This may be used for pulling stumps, hauling the truck out of a mud hole, loading and unloading heavy weights, and many other forms of contractor's work.

J. A. S. writes: "Our 1,000-pound delivery car is provided with spark and throttle control at the steering post, but the driver was formerly the chauffeur of a pleasure car having a foot accelerator as a supplementary method of control. He claims that the use of a foot accelerator enables him to handle the car to better advantage. Can such be applied to the majority of cars not originally so equipped?"

A. There are several foot accelerators on the market that can be attached to the floor boards of almost any make of car. Some of these are in the form of a pedal, while others are similar to the notched arc of a circle projecting a short distance above the floor board. To operate this latter type, the foot is merely slid forward to accelerate, and lifted slightly to throttle—the spring returning the arc to its closed position as soon as the pressure is removed. When installing the foot accelerator, it is well to connect the steering post throttle with the latter by means of a chain so that the motor can be accelerated by the foot without affecting the position of the hand regulator. When this is done, the hand throttle may be used to set the minimum speed to which the motor will return when the foot accelerator is released. It is probable that, if your driver is familiar with this method of control as used on pleasure cars, he could obtain better service from the delivery truck if it, also, were so equipped.

The Planets for September

(Concluded from page 156.)

quadrature west of the Sun on the 20th, and rises at 10:00 P. M.

Uranus is in Capricornus, 2° 20′ north on the 2nd being 20 hours 44 minutes, 20 seconds right ascension, and 18 degrees 48 minutes south declination, and on the 30th, 20 hours 41 minutes 39 seconds, and 19 degrees 58 minutes. He crosses the meridian about 10 P. M. at the beginning of the month and 8 P. M. at the close, and is well observable. Neptune is in Gemini, and is observable shortly before sunrise.

The Moon is full at 9 A. M. on the 1st, in her last quarter at 1 P. M. on the 8th, new at 4 P. M. on the 16th, in her first quarter at 7 A. M. on the 23rd, who is farthest away on the 9th and nearest on the 21st.

There is a large partial eclipse of the Moon on the 4th, during which more than five sixths of the Moon's diameter is obscured by the Earth's shadow. This eclipse is invisible at Washington and throughout the eastern half of this country, but partially visible on the Pacific Coast, and completely so throughout most of the Pacific and in eastern Asia. By Pacific standard time, the Moon enters the Earth's shadow at 4:16 A. M., and the middle of eclipse comes at 5:54, so that the Moon will set and the Sun rise before it is half over.

Comets.

Delavan's comet is now well placed for observation. Its track during the month may be defined by the following rough positions:

	R. A.	Dec.
September 1....	8h. 23m.	+ 49 deg.
September 17..	10h. 17m.	+ 50 deg.
October 3.....	12h. 48m.	+ 48 deg.

On September 5th it will pass close to the north of ε and κ Ursæ Majores; on the 21st it will be on the line of the "Pointers" in the Great Dipper, and about 8 degrees south of them, and on October 4th it will be some 3 degrees north of α Canum Venaticorum. Its high northern declination will bring this region well up into the northeastern sky before sunrise, and the best time to observe it will be between 3 and 4 A. M.

This comet will probably be of the fifth magnitude or brighter and easily visible to the naked eye, but there is as yet no evidence available to the present writer to justify a more precise prediction.

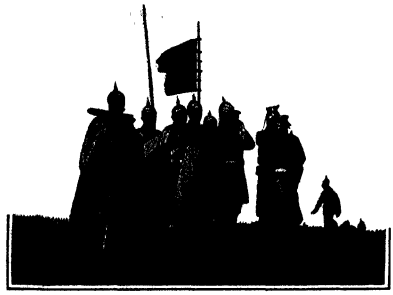
Later elements of Neujamin's comet, based upon more numerous observations covering a longer interval, show that the provisional orbit given last month requires extensive modifications. It appears now that the perihelion passage occurred August 11th, at a distance of 340 million miles from the Sun—nearly four times that of the Earth. This is one of the greatest perihelion distances on record, and the comet must be a big one to be visible at all so far off. The Earth is moving away from it, and it is gradually growing fainter. As it was visible only in a large telescope at first, it is of little interest to the amateur observer; but it may be worth while to record the predicted positions: September 1st, 17 hours 26 minutes 41 seconds right ascension + 1 degree 54 minutes 44 seconds declination; September 17th, 17 hours 29 minutes 6 seconds right ascension —0 degree 26 minutes 50 seconds declination.

It is more than 300 million miles from the Earth, which explains its great faintness.

The comet of 1729, almost the only one whose perihelion distance is equally great, had an orbit which was similar in some respects, but as the longitude of the node in the two cases differs by nearly 90 degrees, and the inclinations are about 20 degrees, the two orbits lie in very different positions in space, and this cannot be a return of the earlier comet.

Southport, Conn.

Compound Railroad Tie.—A railroad tie in which a metallic jacket is shrunk upon a wooden core is shown in patent No. 1,102,093, to Charles Lucas Boyce, of Ashaway, W. Va.



WAR NUMBER

OF THE

SCIENTIFIC AMERICAN

ISSUED SEPTEMBER 5th

FORTY PAGES — COLORED MAP — COLORED COVER PRICE 25 CENTS

With a view to answering the thousand-and-one questions which the public is asking about the titanic conflict which is convulsing the whole of Europe on sea and land, there will be published, on Sept. 5th, a special issue of the Scientific American of triple the size of the regular weekly edition. The issue will be arranged in two sections dealing respectively with the armies and the navies of the Triple Alliance and the Triple Entente.

ARMY SECTION

The Army Section will include chapters on:

The comparative strength of the Armies engaged, illustrated by diagrams and compiled from the latest military statistics.

The Armament, with tables showing for each power the shoulder pieces, machine guns, field guns, howitzers and siege guns, with full details of caliber, weight, velocity, range, danger zone, etc., and a description of the action of shrapnel and shell and the decisive part played in attack and defense by modern artillery.

How an army is fed during a great battle, describing the wonderful organization by which, from a central depot, miles to the rear, the rations are fed out on diverging lines, until each man on a fighting line fifty to one hundred miles in length, is supplied with food and other necessities for his sustenance and wellbeing.

The Signal and Telegraph Service. This chapter will describe the wonderful organization of telegraphs, telephones, flag and flashlight signals by which the Commander-in-Chief, at a base, many miles to the rear, is kept in close touch with the various army Corps, divisions, etc., and has his hand and eye upon a battle-front that may extend, as in the battle of Mukden, for over 100 miles.

The Medical and Ambulance Service. Only less important than fighting the battle is the speedy relief of the wounded and their quick removal to the rear as the battle progresses. This chapter will explain the highly efficient organization of the medical service in modern warfare.

Every chapter will be elaborately illustrated with photographs showing the latest rifles, guns, transport, medical equipment, etc., of modern armies.

NAVY SECTION

The Navy Section will include chapters on:

The comparative size and strength of the Navies, both of the Triple Entente and the Triple Alliance. The Scientific American has gathered these data from the most reliable sources, and they are absolutely correct up to August 15th, 1914. The tables will be illustrated by diagrams. One of these will show the relative strength in all ships combined—the other the rating in dreadnoughts.

The Contending Navies in Detail. A chapter on each of the Navies engaged in this War. Each chapter will include a photograph of one or more battleships, armored cruisers, scouts, destroyers and submarines, of each fleet, with a description of the special characteristics of each. Each photograph will represent one ship of a large class, so that any ship mentioned during the War will be represented in this issue. These views have been selected from a file of about 1000 typical ships of the World's Navies.

Tables of Naval guns showing the caliber, weight, velocity, striking energy, etc., of all the types mounted in the navies discussed.

The strategy of the Naval War, showing by the aid of a map, the enormous advantage to Germany of the Kiel Canal and the coast defense works, upon which she has spent such great sums in the past two decades.

AEROPLANES AND DIRIGIBLES

War in the Air. For the first time war will be carried into the air. For scouting, and to a limited extent for attack by bomb-dropping, the dirigible and the aeroplane will play a most important part. The number will contain a highly illustrated article covering this phase of the War.

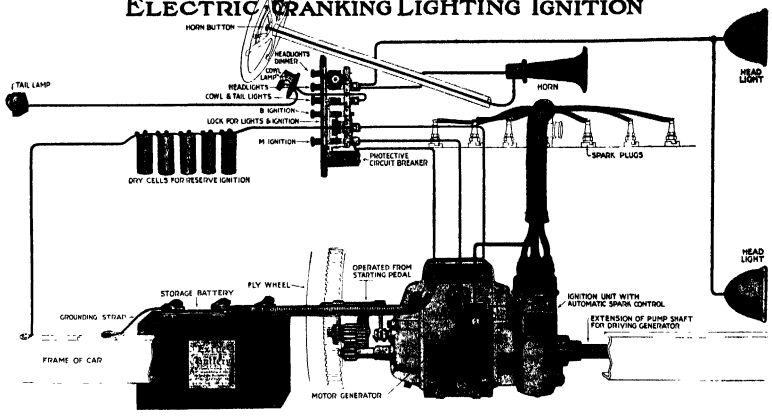
WAR MAP

The number will contain a map drawn especially for the use of those who by colored pins may wish, day by day, to trace the progress of the rival fleets and armies.

MUNN & CO., Inc., 361 Broadway, New York

DELCO

ELECTRIC CRANKING LIGHTING IGNITION



Simplicity is the Keynote of the Delco System

Study the wiring diagram illustrated above.

It shows all the wires there are in a Delco equipped automobile.

Note the simplicity of it—the apparent strength and character indicated

You will find slight deviations from this diagram to meet the engineering and manufacturing requirements of the various motor car companies. But, in all essential details the diagram is standard.

The Delco system is a complete electric cranking, lighting and ignition system.

It includes also—

A reserve ignition—

A connection for horn and extra lights when desired—

A dimming feature for headlights—

A protective circuit breaker to prevent possible damage from short circuits—

A locking device for both ignition and lights.

The automatically controlled generator provides a high charging rate at low car speed and lower charging rate at high speed thus insuring a well charged battery under ordinary operating conditions, and preventing over-charging at the hands of a fast driver.

The automatically controlled ignition insures a properly timed spark at all engine speeds.

And with all these features the Delco System is remarkably free from complications.

It has less wiring, in fact, than was once used for ignition alone.

This combination of efficiency and simplicity is made possible by the single unit, single wired, grounded system.

The Delco System was the pioneer in the electric cranking field.

Three years ago the first electrically cranked car appeared.

It was Delco equipped—and it revolutionized the automobile industry.

Today 154,000 owners are driving Delco equipped cars.

The Dayton Engineering Laboratories Company, Dayton, Ohio

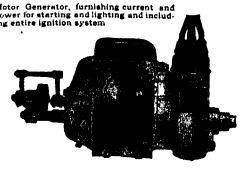
1 Del o-Exide battery made to withstand rough usage and give constant, efficient service



2 Combination Switch controls entire electrical System. Strong simple and very compact



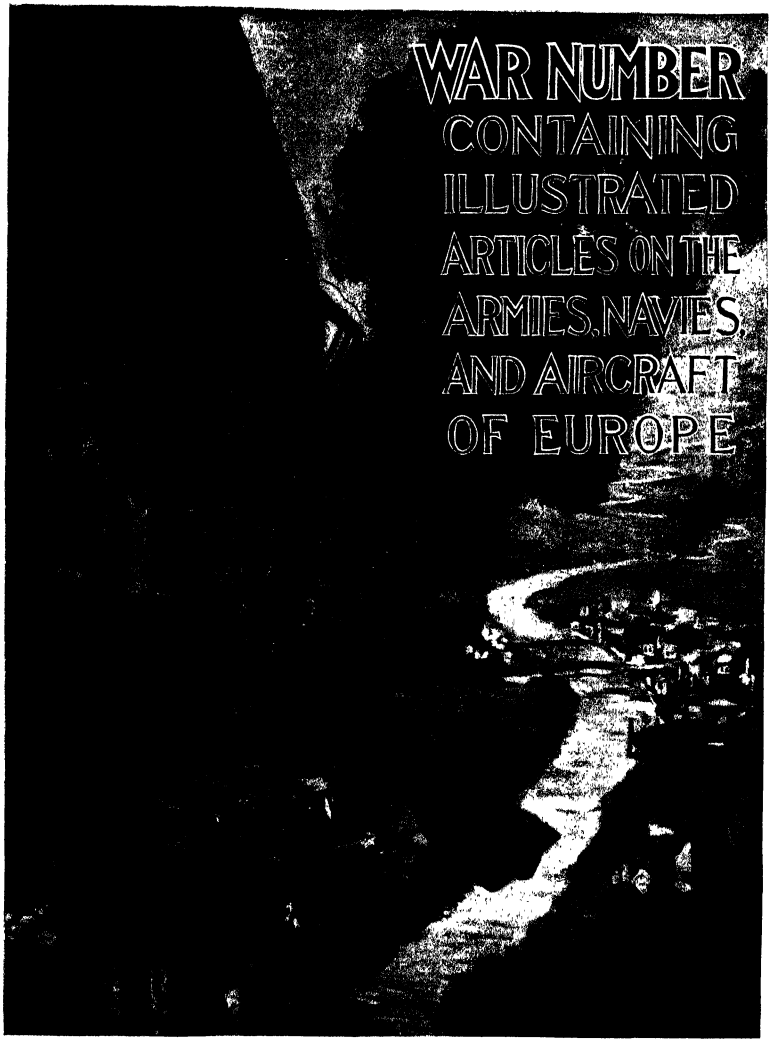
3—Motor Generator, furnishing current and power for starting and lighting and including entire ignition system



These three units comprise the entire Delco System—cranking, lighting and ignition

WITH COLORED WAR MAP

SCIENTIFIC AMERICAN



Vol. CXI. No. 10
September 5, 1914

Munn & Co., Inc., Publishers
New York, N. Y.

Price 25 Cents
$3.00 A Year

THE NEW PACKARD "3-38"

This latest Packard Six invites your patronage. The sum of these distinctive features can be found in no other car.

Twenty Packard Body Styles

Exclusive, Imported Upholstering Materials

Left Drive with Left Side Levers

Short Turning Radius

Packard Centralized Control Board

Packard-Bijur Electric Starter

Packard-Bijur Electric Lights

Separate Magneto Ignition

Packard Unit Power Plant

Mud-Tight Motor

Concealed Force Feed Oiling to Thirty-five Points

Packard Hydraulic Governor

Water-Jacketed Intake Header

Water-Jacketed Packard Carbureter

Seven-Bearing Crank Shaft

Packard Wheels

Packard Radiator

Packard One-Man Top

Packard Windshield

Six-Inch Depth of Frame

Packard Rear Axle Transmission

Packard Worm Bevel Driving Gears

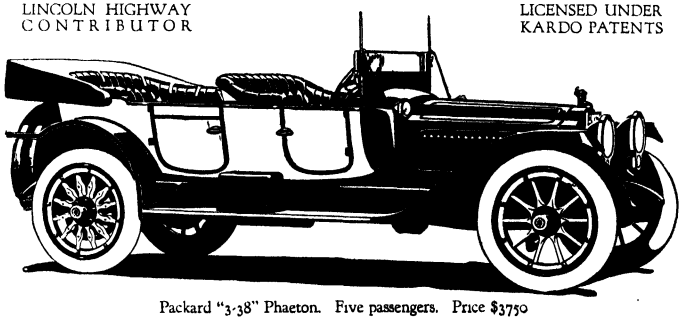
The Bridge Builder's Factor of Safety

Packard "5-48" deliveries commence October 1. Embodied in the "5-48" are all the features of the "3-38" with a bigger margin of surplus power.

PACKARD MOTOR CAR COMPANY · DETROIT

LINCOLN HIGHWAY CONTRIBUTOR

LICENSED UNDER KARDO PATENTS



Packard "3-38" Phaeton. Five passengers. Price $3750

WHITE MOTOR TRUCKS Are the Nation's Choice

BOTH IN THE QUANTITY OF TRUCKS SOLD AND IN THE VALUE OF TRUCK SALES, WE ARE THE LARGEST MANUFACTURERS OF COMMERCIAL MOTOR VEHICLES IN AMERICA

Official Records of the Motor Truck Industry Verify This Statement

This Leadership of the Truck Industry is of the utmost importance, both to the many who already own White Trucks, and to the many others who will eventually purchase White Trucks.

TO THE OWNERS OF WHITE TRUCKS

THIS LEADERSHIP proves the correctness of your judgment in selecting your motor truck equipment.

It shows that you have chosen the same motor truck that the majority of truck users in America have selected.

In practically every case, this selection has been the result of a process of rigid experimentation and elimination, in which White Trucks have proved their superiority over all others.

This preference for White Trucks by the largest users of motor trucks as well as by the majority of motor truck users guarantees that your investment is protected by a successful, well established manufacturer, having a superior organization for rendering permanent and efficient service during the life-time of the trucks.



TO FUTURE OWNERS OF WHITE TRUCKS

THIS LEADERSHIP is conclusive proof that White Trucks must be superior to all others, because White Supremacy is not measured in numbers alone, but in value as well.

With so many makes of motor trucks on the market, all clamoring for recognition, indisputable supremacy can be gained only by superior merit.

Untruthful advertising, bargain prices, exaggerated claims and guarantees that cannot be fulfilled may make the first sale, but only superior merit can create the confidence which brings continuous repeat orders.

The record of continuous repeat orders whereby the foremost firms in America have acquired huge fleets of White Trucks, after experimenting with other makes, is a convincing reason why you should use White Trucks.

WHITE TRUCKS ARE MOST ECONOMICAL TO OWN

That White Trucks are slightly higher in price, makes White leadership in the truck industry even more complete. It is plain evidence that White construction is so superior that the higher first cost of a White Truck is economy in the long run—proof that White Trucks last longer and cost less to operate and maintain, making them the most economical trucks to own.

White Trucks are built in capacities of ¾, 1½, 3 and 5 tons

A SUITABLE SIZE FOR EVERY VARIETY OF SERVICE

THE WHITE COMPANY

CLEVELAND

MANUFACTURERS OF GASOLINE MOTOR CARS, MOTOR TRUCKS AND TAXICABS

For War or Peace
The Jeffery Quad



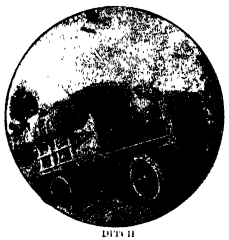
49% GRADE

A 49 per cent grade is easily surmounted by a Jeffery Quad under load. Where no ordinary truck merely pushes its load by its rear wheels, the Jeffery Quad pushes and pulls with all four wheels. It literally *clambers* up. Notice how the brakes hold. Has operate on all four wheels and on the transmission shaft.



LUMBER PILE

The Parsons Lumber Co. find the Jeffery Quad invaluable for carrying lumber to any point such as off the road beside a new building where it may be needed. The Quad frequently saves one handling of the lumber.



DITCH

Even if one set of wheels on the Jeffery Quad are deep in a ditch the other pair will pull it out. The Quad will carry its load across the roughest country.

WHEN the French army went to the front the other day to fight Germany, they carried their provisions in a four wheel drive truck.

When the Parsons Lumber Company, of Rockford, Illinois, found itself face to face with the problem of delivering lumber outside the city limits, where the roads were extremely bad, they sent for a Jeffery Quad.

The Jeffery Quad has been built to specifications furnished by the United States government. It is designed to go anywhere that a four mule team can go. Since its adoption by the government in the operations on the Mexican border a year ago, it has demonstrated its capacity for this service.

At the same time engineers have concluded that this type of truck alone is adapted to certain kinds of service which the two wheel drive truck cannot satisfactorily perform.

Walter Wardrop, editor of Power Wagon, when he saw this truck perform at the Jeffery factory the other day, said, "That is the greatest traction demonstration I have ever witnessed."

Mining engineers, representatives of contractors, brick makers and experts in all lines of trades are coming to the Jeffery plant at Kenosha, Wisconsin, to witness these demonstrations. So startling are they in their character, so spectacular, that they have been portrayed in moving pictures in connection with United States army tests.

The photographs here merely suggest a few uses to which this most remarkable truck can be put. Here are a few of the things that it does:

It drives, brakes and steers on all four wheels.

It will turn in a forty-one foot circle, because the wheels track absolutely.

It will climb loaded a 49% grade as shown in the illustration.

It will drop head first into a three foot ditch and climb out again.

It will carry a load of two tons besides hauling trailers loaded with from eight to twelve tons on a hard level road. It is the only truck that will pull itself out of an excavation. It is the only truck of its kind in the United States built by a concern with sufficient finances and stability to make its production a success.

It is the same type of truck which has been adopted exclusively by the French army.

It is the truck which is now in the service of the United States government.

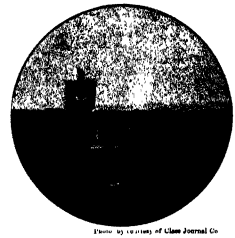
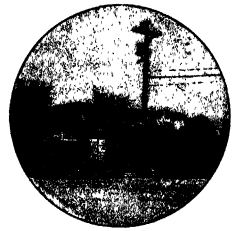


Photo by courtesy of Class Journal Co.

FRENCH ARMY TRUCK

French army supplies are taken to the front in four wheel drive trucks similar to the Jeffery Quad.



TRAILERS

The Jeffery Quad will carry its own rated load and in addition a trailer load of from 8 to 12 tons on a hard level road.



UNITED STATES QUARTERMASTER

United States Army tests are extremely severe. The Jeffery Quad successfully met the army demand for a truck capable of taking its load "wherever four army mules can go."

Jeffery Trucks: Jeffery Quad—Jeffery 1½ ton—Jeffery ¾ ton

The Thomas B. Jeffery Company

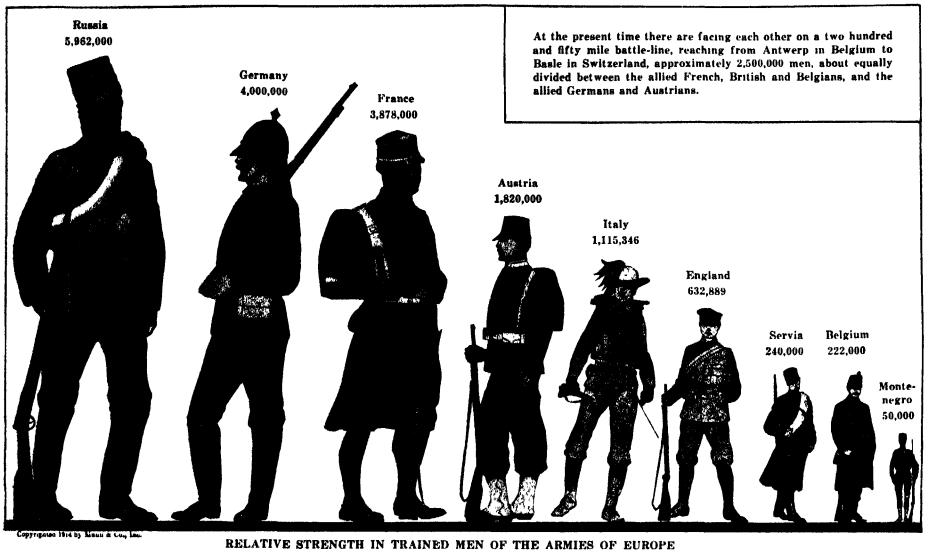
Main Office and Works, Kenosha, Wisconsin

SEVENTIETH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXI.] NUMBER 10. NEW YORK, SEPTEMBER 5, 1914 [25 CENTS A COPY $3.00 A YEAR



RELATIVE STRENGTH IN TRAINED MEN OF THE ARMIES OF EUROPE

Sixteen Million Men Under Arms

Military Strength of the Triple Entente and the Dual Alliance

TO appreciate the stupendous character of the War of the Nations which is now in full swing on the continent of Europe, we must bear in mind two facts: first, that it is a war to the death; second, that in the full realization of the absolute finality of the result, every one of the contending nations has already called out or has stated that it will do so, the whole of its trained reserves, thus putting some sixteen millions of men under arms.

In the interests of humanity it is better that the nations which go down in absolute defeat should realize that the verdict is one against which there is no appeal. If the only possible cure for this monstrous cancer of militarism is the knife, it is better to cut so deeply as to let out all the rottenness, and so thoroughly remove the very seeds of disease as to ensure the wholesome, unhindered growth of the splendid civilization of this twentieth century.

The one mournful consolation to be drawn from this unspeakable calamity is to be found in the belief that the loss of life, the destruction of property, the paralysis of trade and industry, and the total setback of civilization, will be so stupendous as to bring the nations of the earth together, when the war is over, in the endeavor to substitute for the present brutal armaments, an International Tribunal backed by an International Military Police.

In point of magnitude the present conflict is absolutely without a parallel. Never, in all the history of the world, have there been marshaled on the field of battle armies that even approached in numbers the hosts which are drawn up upon the frontiers of Germany and Austria. Not in the campaigns of Napoleon, nor the great Franco-German struggle of 1870-71, nor yet the seven-day battle of Mukden between Russia and Japan, was there seen such a gathering of warring hosts. As for the historic conflicts of ancient days, when the hordes of the East poured in a human flood over Europe, later historical criticism has thrown doubt upon the reputed numbers engaged.

Nation	Population	Standing Army	Trained Reserves.	Untrained Reserves.
DUAL ALLIANCE.				
Austria	48,000,000	472,716	1,347,284	2,700,000
Germany	64,925,993	800,000	3,200,000	3,000,000
Totals	**112,925,993**	**1,272,716**	**4,547,284**	**5,700,000**
TRIPLE ENTENTE.				
England	45,370,000	156,000	476,889	3,500,000*
France	39,900,500	727,000	3,151,000	1,022,000
Russia	125,000,000	1,284,000	4,678,000	5,500,000
Totals	**209,970,500**	**2,167,000**	**8,305,889**	**10,622,000**

Total number of trained soldiers . . { **Dual Alliance** 5,820,000 / **Triple Entente** 10,472,889

* Probable number of men available for voluntary service, including 416,307 Territorial forces (similar to U. S. National Guard)

At the present writing it is not unlikely that there are facing each other on a two hundred and fifty-mile battle line, reaching from Antwerp, Belgium, to Basle, Switzerland, approximately 2,500,000 men, about equally divided between the allied French, British, and Belgians, and the allied Germans and Austrians. These represent the standing armies, the flower of the national troops engaged.

To the east, along the borders of Germany and Austria, Germany has massed by this time some 600,000 of her second line of reserves, and Austria is moving to her own northern frontiers, and to the assistance of Germany in Alsace and Lorraine another 400,000 men. Russia has announced that her mobilization is complete, which means that she is moving down upon the German and Austrian frontiers her standing army of over 1,250,000 men.

And the while these 5,000,000 troops are on the fighting line, there are being gradually assembled at the various camps and equipped for the field as they may be needed, the 10,000,000 trained reserves—everyone having spent two or three years with the colors.

In all the countries engaged in this war, except England, military service is compulsory. In England service is voluntary, the men enlisting for seven years, at the close of which they enter the reserve. The war strength of the English army is 150,000 men and of these, three army corps, or 120,000, have been landed on the continent and form part of the allied army. The whole of the reserves, 476,000 strong, have been called to the colors, and will be sent to strengthen the allies.

Compulsory service, or conscription as practised in the German army, where it was first fully developed, is broadly representative in its operation of the practice in all European armies.

Actual service in the German army begins at the age of 20. The young man joins the colors, and remains with them three years. He then passes to the reserve for four years, during which he is called out for training with his corps twice for a period of about six weeks. He is then drafted into the "first ban" of the Landwehr for five years, in which he is given two trainings lasting from eight to fourteen days. At 32, he passes into the "second ban," where he remains till he is thirty-nine. He now passes into the first ban of the Landsturm, where he remains until his 45th year. The second ban of the Landsturm consists of men who have had no military training.

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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Germany's Strong Strategic Position

WITH the war a month old, Austria is yet to be heard from, except in the rôle of the defeated; and already it begins to look as though Germany will have to depend upon her own strong arm to overthrow the mighty fleets and armies of the Allies. Judged in point of mere numbers, the odds are two to one against her on land, and three and a half to one on the sea.

But the history of war, whether ancient, medieval, or modern, teaches us that superiority in numbers is merely one among many important factors that win battles and make it ultimately possible to dictate terms to a thoroughly beaten enemy. Proof of this is to be found in that brilliant page of German history covered by the Seven Years' War, when Prussia, under her marvelous soldier king, Frederick the Great, waged a successful war against a combination of enemies, as strong, relatively, if not stronger, that that which confronts the German people in the present crisis.

The seemingly overwhelming numbers of the Triple Entente are greatly offset by the fact that Germany holds an unusually strong strategic position, both on sea and land, and that whereas her armies are of a common race, speaking a common language, the enemy is composed of three races, speaking no language in common, and differing widely in tastes, temperament, and traditions.

Of enormous advantage to Germany is the fact that the geography of the naval and military situation is such that she is placed squarely between her major enemies, France and Russia; and so long as she is supreme in the Baltic, it is impossible for those countries to effect a joint concentration of their troops in overwhelming numbers upon either frontier.

And Germany, be it remembered, has all the advantage of fighting on interior lines. Because of her admirable system of military railroads, many of them built with a view to just such a crisis as that which now confronts her, she can move her reserves quickly to either frontier and mass them at any point for attack or defense. Furthermore, if, as she hopes and firmly believes, she can succeed in crushing the French armies in a succession of conclusive engagements, her possession of the interior lines would enable her to move a portion of the flower of her army, which is now confronting France, to the eastern frontier for the repulse of the Russian invasion.

In the event of German reverses and a failure of her invasion of France, she would fall back upon her line of frontier fortifications, take up a strong defensive position, and hurl the bulk of her armies against the on-rolling tide of Russian invasion, which, at the present writing, appears to have gained a victory of imposing proportions. If this should be the course of events, the Germans would settle down to a war of defense, which might last for two or three years, and end in the contestants fighting each other to the point of utter exhaustion. There is no reason to believe that the German of the twentieth century has lost any of the powers of recuperation and dogged resistance which carried him through the seven years of war under the great Frederick.

No less upon the sea than upon the land is Germany favored by geographical conditions. To be convinced of this, it is sufficient to glance at the war map which forms the supplement to the present issue of the SCIENTIFIC AMERICAN. The allied fleets of England and France have a superiority, based on total tonnage, of over three to one over that of Germany and Austria, and a superiority in the first fighting line of dreadnoughts, of two to one. If to France is delegated the task of destroying the Austrian fleet in the Adriatic, the English fleet in the North Sea has twice as many dreadnoughts as that of Germany, or 31 to 16; of destroyers she has 167 to 130; and of submarines, 76 to 21. Under these conditions it would be hopeless for Germany to accept battle in the open. Ship for ship, the English dreadnoughts are more powerfully armed, and in seamanship and gunnery they are at least the equals of their opponents.

Hence, the Germans have either retired behind the heavy coast fortifications of their North Sea ports and harbors, or, as is more likely, they have taken shelter in the Baltic. The British admiral has orders to seek and destroy the German fleet. But how shall this be done? Wilhelmshaven and the mouth of the Elbe are thoroughly protected by coast fortifications and mines. These consist of heavy, long-range guns, and mortars whose shells would fall with great accuracy over the course which would have to be covered by a fleet that steamed in to a range at which its fire would be effective. The Japanese attack on the inferior Port Arthur defenses proved the futility of a naval attack upon such fortifications as those at Wilhelmshaven, Heligoland, and Cuxhaven.

Equally disastrous would it be for the English fleet to venture through the narrow straits which must be passed in entering the Baltic. These would be heavily mined, and in their confined waters the fleet would lose heavily also from destroyer and submarine attack.

Another and most important strategical advantage in the German situation is the Kaiser Wilhelm Canal, which affords quick passage for the largest battleships from the Baltic to the North Sea. This canal practically cuts the British fighting line in half. It was built for this very purpose.

For if the British should force their way into the Baltic, the German fleet could pass to the North Sea through the canal and the Elbe, steam to the English Channel, sink the vast fleet of transports that are carrying men and supplies to the English army in Belgium, and harry the whole English and French coasts.

Hence, in seeking to bring the German fleet to action, it would be necessary for England to leave half her fleet at the mouth of the Elbe and send the other half around Denmark into the Baltic. This would mean that, so far as her dreadnought strength is concerned, Germany could elect to fight either fleet under equal conditions.

The only other way to get at the Germans would be to reduce the coast fortifications with an expeditionary army. But the German coast on the North Sea is so shoal, that the landing of such a force from transports is out of the question. There remains only one way in which it could be attempted.

If England followed Germany's example by violating the neutrality of Holland, or should Holland enter the Triple Alliance, Amsterdam would form an excellent base for an expedition for the reduction of the Wilhelmshaven and Cuxhaven fortifications. This would open the way for the seizure of the North Sea end of the Kiel Canal. Should Russia continue her successful invasion of Prussia, she might in time, though at an enormous sacrifice, capture Dantzig, Stettin, and, with the aid of the English, even Kiel itself. That would seal the doom of the German fleet.

Can it be done? The factors of time and cost are against it

Eight Cylinders v. Six Cylinders

NOW that the six-cylinder automobile engine has attained to such universal popularity, thanks to the unremitting efforts of designers and builders, it does not seem altogether logical that it may soon be supplanted. But that it may be superseded at least in part, in the not far-distant future is a contingency with which the automobile world must concern itself. Already the eight-cylinder motor looms large on the horizon; for one of the largest of American makers has let it be known that henceforth a good part of his output will be driven by eight cylinders.

In thus taking one step in advance of his brother makers, for there is no other American eight-cylinder motor car, and only one foreign maker produces them, this American pioneer has given every thinking person abundant food for thought.

In the early days, when the single- and twin-cylinder motor held sway, motors with four cylinders were looked at askance as being just short of mechanical monstrosities; and no one had even thought of a six-cylinder car. And now comes the eight-cylinder motor, and it comes with a whole lot of sound common sense behind it and a number of reasons why it should make a bid for popular esteem.

It is true that the eight-cylinder motor has more parts than has the six; but if this multiplying of parts is examined carefully we find that the proposition is not as disturbing as might appear at first blush.

Power for power, the eight-cylinder motor need not necessarily be any larger or very much heavier than the six-cylinder motor. In fact, it may similar or even more compact of the two; for it presents the possibility of casting the cylinders V-fashion. In this way the eight cylinders take up little if any more space fore-and-aft than the four—certainly less than the six—and little more transversely. The very compactness of such a design is an appealing feature.

As far as mechanical construction is concerned, the eight-cylinder motor has a number of advantageous features. In the first place, the crankshaft is considerably shorter than is the case with a six; and this feature tends to obviate even such slight chance of whipping in this member as may exist in longer crankshafts. Also, the crankshaft for an eight is simpler to make and requires less machining than that for a six; and this should reduce manufacturing cost.

Where the eight-cylinder motor has its cylinders cast in the shape of inverted L's with the valves all inside, valve operation is exceptionally simple; for a single camshaft centrally placed directly above the crankshaft serves to operate all sixteen of these. Again, problems of carburetion will be simplified by the possibility of locating the carburetor centrally with extremely short induction pipes.

When the question of eight cylinders versus six cylinders is first propounded, the addition of two cylinders, four valves, two pistons and connecting rods, two spark plugs, and perhaps other parts not now embodied in the six, appears a big step, and time only can tell how it will be received. The argument which centers about the addition of what appear to be unnecessary parts will not now be advanced against the eight-cylinder motor, for the simple reason that the simplicity and reliability of the four and the six have impressed themselves upon the mind of the motoring public. Nor is it likely that the question of fuel economy will enter largely; for already the records of foreign eight-cylinder motors, rating between 20 and 25 horse-power, show that one gallon of fuel generally will propel the car from 20 to 22 miles in an hour.

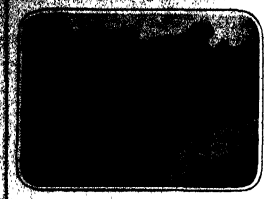
It is not likely that the eight-cylinder motor will come suddenly—as the six-cylinder motor did, for instance—but it surely appears likely that within a few years, say three or four, we may find ourselves viewing a very appreciable wave of eight-cylinder popularity.

The Composition of a European Army

THE numerical strength of the various units which compose a European army in the field differs so widely from that of our own army, that it is difficult for the average American to understand, in reading the European war dispatches, what number of troops is represented by the terms brigade, division, regiment, army corps, etc. The following statement is applicable, broadly, to all of the continental armies engaged in the present conflict.

The European regiment in full war strength numbers about 3,300 men, under the command of a colonel. Three regiments form a brigade of 10,000 men, commanded by a major-general. Two brigades form a division of 20,000 men, under the command of a lieutenant-general. Two divisions constitute an army corps of 40,000 men, commanded by a general, and three army corps form an independent field army (fully equipped with cavalry, artillery, commissary, engineers, and medical department) of a total strength of 120,000 men. There are variations from these totals as given, but they are not great, and the above estimate of the strength of the various units if applied to the number of divisions, brigades, army corps, etc., mentioned in the dispatches will give a closely accurate estimate of the number of troops engaged.

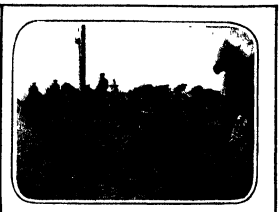
Edible Flowers.—A consular report from Calcutta describes the uses made in India of the mahua tree (otherwise known as the mahwa, malwa, mowha, mows, mowra, or illupei tree), which grows wild in the greater part of that country and is also cultivated to some extent. The cream-colored flowers appear from February to April, and arrive at maturity about the end of March. Each morning about sunrise the succulent corolla-tubes fall in great showers to the ground, which has been cleared to receive them. The fall from a single tree continues for from seven to ten days. The flowers are spread out in the sun to dry, their color changing to a reddish brown, and their peculiar sweet odor becoming more apparent. Though eaten fresh to a considerable extent, the majority of the crop is dried and cooked with rice or other grains. Mahua is extremely sweet, and not easily digested by persons unaccustomed to eating it. Sugar and molasses are made from it. The consul states that in the central provinces alone about 1,460,000 people use mahua regularly as an article of food. The flowers are also distilled and produce a strong liquor, not unlike a good Irish whiskey in flavor. The seeds of the same tree are used for the manufacture of mahua butter, which is used for food, as a lubricant, and as an illuminant.



Transporting Russian artillery on flat cars.

The Armament of the Warring Nations

Victory May Rest With the Superior Rifles, Field and Machine Guns



Russian horse artillery on the march.

THE three most important branches of an Army are: the Cavalry, the Artillery, and the Infantry. In addition to these there are the Coast Artillery, which among European nations is generally not very far developed, and the various general service branches, engineers, quartermasters, and commissaries. All of the latter are, of course, important in their spheres, but in the battles to be fought in a general European land war, the Cavalry, Artillery, and Infantry are by far the most important, and a more detailed consideration of the arms as used by these branches in the various countries will follow.

The main object of the Cavalry in all of these armies is to reconnoiter and obtain information of the enemy and the terrain on which he operates. For that purpose it is sent out ahead of the main army, and is therefore generally the first arm drawn into active engagement with the enemy's advance troops. During the fighting of the Infantry and Artillery it must be in readiness, in addition to its scouting duties on the flanks, to throw its support to wherever it may be most needed for the success of the Army.

The Cavalry is armed with a rifle or sword or both, and in some cases with the lance. They are called by various names, as in Germany: Hussars, Uhlans, Dragoons; Russia: Cossacks, Dragoons, Hussars; France: Cuirassiers, Hussars, Dragoons; Great Britan: Hussars, Lancers; Austria-Hungary: Dragoons and Uhlans. They are always mounted, and their ultimate training has in view their ability for long service in the saddle without rest.

The Field Artillery arm of a modern Army is undoubtedly the most important branch, next to the Infantry. In fact, it is probable that the success of a modern battle will depend on the superiority of the Field Artillery, and enormous sums of money have been spent with a view of providing field artillery guns and ammunition in each of the countries involved.

The two nations that have led in the development of Field Artillery are undoubtedly France and Germany. Each has followed its own line of development to a certain extent, but if reports contained in military magazines are correct, it may be assumed that the French Field Artillery is the more efficient.

The object of Field Artillery is to support the Infantry in its advances or its retreats. It aims to hit the part of the enemy which is most dangerous to the friendly Infantry and which would hinder its success since the enemy's Artillery would do the same thing, it is evident that a modern battle will generally begin with an artillery duel, and that whichever side is able to silence the other side's Artillery will have a tremendous advantage. In fact, until the enemy's Field Artillery is silenced an advance of the Infantry would be practically impossible.

As the Infantry advances the Field Artillery must be in readiness to fire over the advancing lines and attack parts of the enemy's troops, or must be able to move with lightning rapidity to any other position where its fire is needed or is more effective.

A battery of Field Artillery is a tactical unit composed of from four to eight guns, and ammunition wagons, loaded with shell and shrapnel.

Since its first object is to destroy the enemy's Artillery, it will be seen that the longer the effective range of the guns is, the better will it be able to damage the enemy before the latter is able to reach it. On the other hand, in order to be able to shift its position quickly it must be light and able to be put into action easily. The three objects to be obtained, therefore, are: Power, mobility, portable accuracy, shooting at long ranges; Rapidity of Fire, and Mobility. The gun on which the various armies are depending more than anything else is undoubtedly what is called the light field piece, all of which are approximately 3-inch caliber. To apportion to the best advantage the various qualities desired in a 3-inch light field gun has been a difficult problem, and each country has developed its own piece differing from any other. As will be seen from the following table, the French are equipped with a heavier gun, firing a heavier projectile at a much higher velocity, than are the Germans. Since the energy of a projectile varies directly as the mass and the square of the velocity of the projectile, it is evident that the French projectile will be more powerful than the German. On the other hand, it will be more difficult for the French to haul their guns from place to place. The foregoing table gives the more important and interesting data for Field Artillery for various countries:

FIELD ARTILLERY OF THE EUROPEAN ARMIES

Country	England	France	Russia	Belgium	Germany	Austria	Italy
Made by	England	France	Russia	Krupp	Krupp-Ehrhardt	Austria	Krupp
Caliber, inches	3 3	2 95	2 95	2 95	3 03	3	2 95
Weight of projectile, pounds	18	15 9	14 3	14 3	15 1	14 7	14 3
Muzzle velocity, feet per second	1,600	1,740	1,945	1,630	1,500	1,630	1,675
Rate of fire, shots per minute	20	20	20	30	20	25	30
Maximum effective range, yards	6,300	6,000	6,000	6,000	5,500	6,700	6,600
Muzzle energy, foot tons	320	334	360	258	236	272	260
Weight of gun and carriage, pounds	2,600	2,500	2,300	2,300	2,080	2,450	2,200
Number of guns in a battery	6	4	8	6	6	6	4
Rounds of ammunition per gun with a battery	176	312	212	242	126	168	312



English field gun on the march.

Considering the above table, one can make his own deduction as to the merits of the Field Artillery. Taking the two most important countries, France and Germany, the following comparison may be made:

By remaining velocity is meant the velocity of the projectile at any part of the range; for example, a 15-pound projectile fired at 1,700 feet per second muzzle velocity has a remaining velocity of 900 feet at 2,500 yards range, 310 feet at 5,000 yards, etc.

For the same initial velocity the remaining velocity will be greater for the greater weight of the projectile and same caliber. Similarly for the same weight of projectile the remaining velocity will be greater for the greater initial velocity. Consequently, since the weight and initial velocity of the French are greater than that for the German, it will be seen that the remaining velocity for any range and therefore the striking energy of the projectile will be greater for the French gun than for the German.

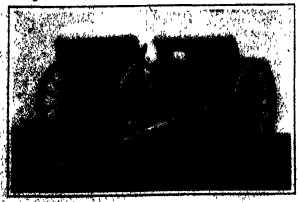
This is of great importance since it enables the French to direct a more effective fire at long ranges, and the shell as well as shrapnel of the French will be more destructive both against earthworks and personnel. On the other hand, if the target is changing quickly and it is necessary to shift the gun, the Germans, having 500 pounds less to move, will be able to do this more quickly, and thereby have a great advantage over their adversary.

The range given in the table is the maximum effective range and is generally the range obtainable by the maximum elevation of the gun on its carriage, about 15 degrees. The maximum range obtainable for any gun is for about 43 degrees elevation, after which the ranges become shorter. The range for all of these guns that could be obtained with the guns at 43 degrees elevation would be between 9,000 and 10,000 yards, but since firings at such long ranges would have little, if any, effect, no efforts have been made to construct a carriage for such elevations, unless it is intended to use it for balloons also.

In actual battle the guns of a battery are lined up and one loaded caisson is placed next to each gun. The entire battery is behind cover, and generally cannot see the targets. The fire is directed by each gunner aiming on a designated aiming point, with an instrument set at a given deflection, so that the gun will actually point at the target. This deflection is calculated by a triangulation method by the Battery Commander, who is located some distance away from the battery either on elevated ground, on a ladder, or in a tree. The German system of obtaining the deflection is to measure the angles carefully, by means of instruments, thereby attempting to make the first shots effective; while the tendency of the French system is to estimate the first deflection, fire quickly, and by observing the shot, make necessary corrections for succeeding shots. The ranges are obtained by self-contained base range-finders, which are accurate within 200 yards for 5,000 or 6,000 yard ranges.

Within the last few years the subject of equipping the Field Artillery with larger caliber siege guns and howitzers has been given extended studies.

The object of howitzers is mainly to fire a heavier projectile with a lower velocity at a much higher elevation and longer range. Assume, for instance, the



Belgian field gun as it appears in action.



Type of Maxim machine gun used by English.

enemy's Infantry entrenched behind embankments. With a high velocity the trajectory of the projectile for a given range is very flat, so that the troops would be able to sit behind the cover, and have all projectiles either strike the embankment or pass over their heads. For this emergency a battery of howitzers is called into action. By reducing the charge the projectile may be started at a higher elevation, which causes the projectile to fall to the ground in a much more nearly vertical path, and enables it to be dropped back of the embankment. As a concrete example, assume the enemy's Infantry behind earthen cover at 8,000 yards.

The slope of fall of the French projectile at that range would be about 7 degrees or 1 on 8; this gives a considerable space behind a wall that would be practically immune from the artillery fire.

By calling a 4.7-inch howitzer battery for this work, the Artillery Commander may fire a 60-pound projectile with 900 feet per second muzzle velocity, which would give him at 3,000 yards a slope of fall of 1 on 4.3, or he may remove some powder from the charge and fire the projectile at 620 feet per second muzzle velocity, which would give him a slope of fall at 3,000 yards of 1 on 1.8, with which it would be practically impossible for the enemy to remain behind the cover.

Due to rapid advance of science within the last few years, another element must be contended with in the next war. The aeroplane, which, a few years ago, was considered an impossibility, is to-day one of the best means for obtaining accurate information concerning the enemy.

There are two means of combating a flying machine. Many military students contend that the way to destroy an aeroplane is to put a machine rifle in another aeroplane and attempt to combat it in the air. This will probably be the method followed in a modern war at the present time. Another means is to provide field artillery guns able to fire in the air, and many balloon guns of this type have been tried out by various countries. One notable cannon of this type is the Deport field gun, which is so arranged that it can be used as a field artillery gun for low targets, but may be trained for aerial targets as well.

There are a number of difficulties connected with firings against balloons or aeroplanes, and extensive experiments have been carried on in various countries for the purpose of solving this problem. The large ordnance manufacturing concerns of the Krupp and Ehrhardt companies, in Germany, have designed and manufactured guns firing 3-inch projectiles mounted on automobiles or on wheels; but so far no definite conclusions have really been reached as to the most effective manner of firing at balloons.

Among the difficulties experienced is the fact that the aeroplanes move very rapidly, making it difficult to follow them through the sights of the gun. Another difficulty to be encountered is the fact that the required angle of departure for a projectile to reach a certain range varies as the target moves above the horizon. For instance, a target on the same level with the gun at 5,000 yards range may require an angle of departure of 11 degrees; while if this target should be located 45 degrees above the horizontal the super-elevation, which is the elevation of the gun above the line drawn from the gun to the target, would be only 4 degrees or 5 degrees. If the aeroplane should be the same distance but vertically above the gun, no elevation over the direction of the line of sight would be necessary.

It is also a difficult matter to estimate the distance to these balloons, and the use of range-finding instruments, due to the rapid movement of the targets, is at times almost impossible. In some cases experiments have been carried on with a view of firing projectiles with burning tracers attached to them. These tracers, by burning in the air, will show the path of the projectile, and will show how close the projectile may be to the target.

That rifles or small guns can be fired from aeroplanes has been demonstrated. While these guns would probably not be very effective against troops on the ground, there is small doubt but bombs dropped from balloons would be a very dangerous inconvenience for the enemy. Experiments carried on have shown that these bombs can be dropped with great accuracy from a considerable height, and a sighting arrangement for dropping them has been fairly well perfected. The principle of such a sighting device is to set the sight at a certain elevation, depending on the speed of the aeroplane and its height, aim at the target, and release the bomb as soon as the sight is on the proper target.

There is yet another field of use for field artillery. In Germany and France there are a number of cities which are protected by extensive fortifications. In addition, temporary fortifications will be thrown up by each side for the purpose of protecting important strategic places. To destroy these fortifications and drive the troops out, the siege artillery is brought into action. The guns for this purpose are brought up on wheels, as in the case of the smaller calibers, but are placed in more or less permanent positions for action.

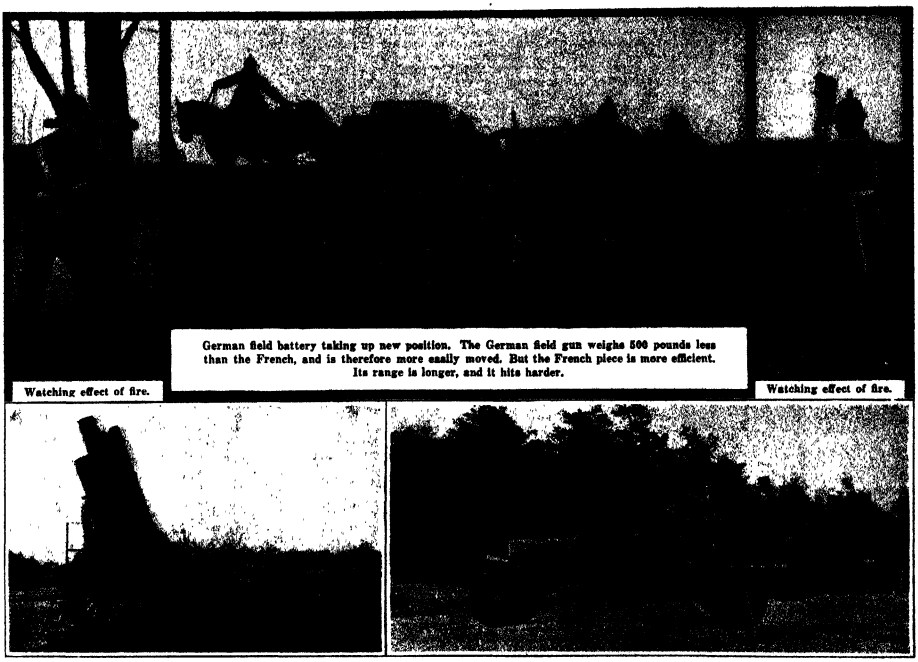
There is no standard proportion of number of these batteries used in the various armies. The weights of the projectiles and velocities are more or less the same for all, and for Germany and France are about the following:

7.6-inch caliber, firing a projectile weighing 240 pounds with 1,100 feet per second velocity.

9.6-inch, with a 480-pound projectile and 1,000 feet per second velocity.

10.8-inch, with a 700-pound projectile and 1,000 feet per second velocity.

While it is probable the success of a battle will depend to a large extent on the support of the field artillery, it is certain that the principal and most important arm is the infantry, which in practically every case must decide the final issue. The cavalry may be the first to be drawn into a battle, and the Artillery may destroy the enemy's artillery, but a battle is never



German field battery taking up new position. The German field gun weighs 500 pounds less than the French, and is therefore more easily moved. But the French piece is more efficient. Its range is longer, and it hits harder.

Watching effect of fire.

Watching effect of fire.

German 11-inch siege gun in firing position.

Balloon-repelling gun on automobile in action.

Another object of these heavy cannon is, that a battery can be put in position to sweep a large field, and with its long ranges prevent the enemy's lighter artillery from coming within effective reach.

The velocity of these howitzers is practically the same for all countries, and is about 900 feet per second for the longest zones, while the calibers are approximately 3.8-inch with a 30-pound projectile, 4.7-inch with a 60-pound projectile, 6-inch with a 120-pound projectile.

The number of rounds that will be fired during an ordinary battle can only be imagined. We have data from the Russo-Japanese War showing that at Liaopan one battery fired 2,600 rounds in one day, while another fired 3,304 rounds, making for each gun about 413 rounds in one day. This was not an uncommon occurrence, and it shows the expense involved in carrying on a modern war.

The most common projectile of the 3-inch caliber is the shrapnel, which is in itself a gun, arranged by time fuses so that at the desired height it is made to burst, shooting forward out of a shell 250 lead balls, each effective to kill a man.

men until the infantry has driven back the enemy's lines.

The usual mode of advancing for the infantry is to deploy them in a line with a long interval between each soldier. This, naturally, is for the purpose of offering a smaller target for the enemy. It makes it more difficult, however, for the leaders to keep as good control over the men, and for that reason one of the objects of field artillery is to make the enemy's troops deploy early.

The infantry soldier is armed in all the countries with a rifle and bayonet. The rifle is the weapon upon which reliance is placed, the bayonet being used only as a last means, when in a hand-to-hand encounter with the enemy.

The rifles of the various countries differ in certain qualities, but in general outline they are more or less alike. The following table gives the more important data about these rifles.

The qualities as regards weight of bullet and velocity as described for field artillery projectiles hold here also. By danger space as given below is meant that if the rifle is fired 12 inches from the ground and aimed at the middle of a target of a height of an average man, 68 inches, and an infantryman is anywhere inside of the limit of range given, the bullet would hit him. Beyond the ranges given there will be a space at about the middle of the trajectory where the bullet would pass over the head of a man, and where, therefore, he would be in perfect safety. It is evident that the greater the danger space the more dangerous will be the rifle to the enemy's troops.

Since about 1906 Germany and France have adopted the pointed bullet. With this the resistance of the air is greatly reduced and the ranges obtainable with the same velocity, weight, and caliber are greatly increased.

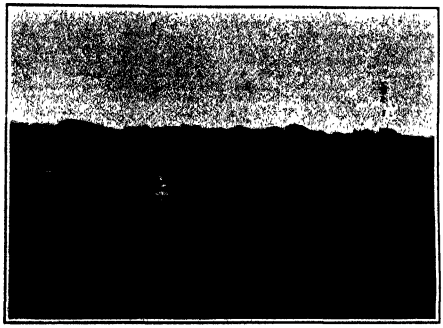
By increasing the velocity the danger space for any range is of course increased since the trajectory is much flatter, and for the same "kick" of the rifle a much more powerful bullet is obtained.

Probably every country has developed, or is developing, a semi-automatic rifle, which differs from the ones now in use in every army by the fact that part of the powder gases are used to open the breech block, eject the empty cartridge, and reload the rifle—all of which operations are now performed by hand. With a semi-automatic rifle the magazine can be emptied without moving the gun from the shoulder, and a great increase in the rate of fire can be accomplished.

The opening of fire from the infantry will generally be delayed until accurate aiming is possible, unless it is desired to cause the enemy to deploy its forces earlier, and although the bullets are effective at 1,500 and 2,000 yards range, the real fighting will not begin until at much closer ranges.

With each regiment of infantry there belongs a platoon or company equipped with two or four machine guns. These machine guns generally fire the same ammunition as is used for the rifle of the army, but fire it semi-automatically from clips or belts containing 30 to 250 rounds each.

The most notable of these machine guns are the Hotchkiss (French) and Vickers (English), the former



Battery of French field guns, hauled by automobile.

firing from clips containing 30 cartridges, and the latter firing from belts containing 250 cartridges. The rate of fire of these guns is about 400 to 500 shots per minute.

These rifles are transported either on light wheeled mounts or packed on mules or horses. Their prime object is to be able to take up a position and be able to deliver an overwhelming volume of fire where needed

The coast artillery was mentioned above as not being very well developed in European countries. This, undoubtedly, is due to the dependence they place in the battle fleets and the short shore lines. The guns in the coast fortifications are of comparatively small caliber, none exceeding 9.5 inches These guns are mounted on disappearing carriages, but cannot be very effective against the large calibers as for instance the 13-inch and 14-inch guns on a battleship It is possible that every country feels that with their land forces, they are perfectly able to repel any landing party that might desire to venture ashore.

RIFLES USED BY THE EUROPEAN ARMIES

Country.	England	France.	Russia	Belgium	Germany	Austria	Italy
Designation	Lee-Enfield	Lebel	3-line Nagant	Mauser	Mauser	Mannlicher	Mannlicher
Magazine system	Detachable vertical box	Tube in fore end	Fixed vertical box	Detachable vertical box	Fixed vertical box	Fixed vertical box	Fixed vertical box
Number of cartridges in magazine	10	8	5	5	5	5	6
Weight without bayonet	8 pounds 10 5 ounces	9 pounds 4 5 ounces	8 pounds 15 5 ounces	8 pounds .5 ounce	9 pounds	8 pounds 5 5 ounces	8 pounds 6 5 ounces
Caliber, inch	.303	.315	300	301	311	315	.256
Maximum effective range, yards	2,100	2,187	2,096	2,187	2,187	2,132	2 187
Bullet, shape of nose	Round	Pointed	Round	Round	Pointed	Round	Round
Weight, grains	216	198	214	219	155	244	163
Muzzle velocity feet per second	2,060	2,380	1,985	2,034	2,882	2,034	2,395
Material of envelope	Cupro-nickel	No envelope. Bullet of copper zinc	Cupro-nickel	Cupro-nickel	Nickel-steel	Steel	Cupro-nickel
Ranges for which the entire space under trajectory is a danger space for infantry, yards	640	640	620	640	610	650	750

A Graeco-Roman Era in Egypt

AN exhibition of particular interest to Egyptologists was recently opened at the rooms of the Society of Antiquaries, Burlington House. Here have been collected samples of the discoveries made at Antinoë and Abydos during the past year The work at Antinoë is most largely represented, and the finds throw considerable light on the life of the inhabitants of the town, especially during the fifth and sixth centuries, A D.

Antinoë was founded in the latter part of the year 130 A D., while Hadrian was voyaging down the Nile The immediate cause of the founding, we are told, was the loss by drowning near by of the Emperor's favorite, Antonius. The bulk of the papyri discovered is in Greek, but a few are in Latin and a considerable number in Coptic.

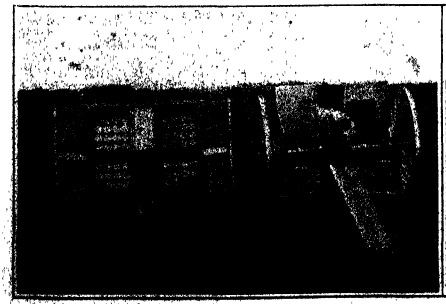
One valuable find of the year was a number of pages of Theocritus dating from the fifth or sixth century A D This is practically the only example of a Theocritean MS. which Egypt has yet provided, and the fact that it is at least seven centuries earlier than the earliest of the medieval MSS. makes it a find of considerable importance to scholars

Shorthand appears to have been in existence in those early dates. One fragment not only gives a Latin alphabet with the letter names in Greek, but lists of words with their shorthand equivalent. Particularly valuable also are a number of Coptic woven tapestries which run from the third to the seventh centuries. Some pieces of woven silk must have been among the earliest that occur either in Europe or Egypt They are supposed to date from the sixth century, and silk was only introduced into Europe from China about 550 A. D.

Sir Frederick G. Kenyon, who opened the exhibition, remarked that the finds were largely the work of Mr. J de M. Johnson They illustrated the daily life of Graeco-Roman Egypt in the early centuries of our era. Particularly valuable were the Latin manuscripts, which were very rare from Egypt

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American Motor Population.—According to the latest authentic figures there are now in the United States 1,548,350 motor cars. The figure includes both gasoline and electric vehicles for both pleasure and commercial purposes. This figure is the total registration up to July 1st only, so that by the end of the year it undoubtedly will be considerably larger. The registrations for the three previous years are as follows: 1913, 1,253,875 registered; 1912, 1,010,483 registered; 1911, 677,000 registered. As might be expected, New York State leads with a total registration of 140,653 cars. Nevada is last with 1,295 cars registered.



French field gun, with loaded caisson, in action. Traverse of gun is 8 degrees.



French Deport field artillery and balloon gun. Permits traverse of 45 degrees without moving carriage.

Feeding the Man on the Firing Line

Tents, Shoes and Rations Win Many a Campaign



The German Emperor and his staff observing field operations.

NO business man would undertake a new enterprise without first preparing a scheme or plan of operations; and as an army is a city appearing suddenly in a country, and changing its location each day, thus either completely breaking its line of supply, or requiring the sudden extension of the same, and perhaps in a new direction, the necessity for the formation of plans for the operation, and particularly the plan of supply, is self-evident.

The fighting capacity of the men of all civilized nations is about the same, and when armies equal in numbers, discipline, and effectiveness are opposed, and are each commanded by masters of the art of war, that army which has the best conceived and best executed plan of supply will have the best chance of achieving victory

The art of war is usually divided into two parts: *Strategy*, which is the art of disposing and moving troops over an extended theater of operations, and *Tactics*, the sphere of which is limited to the field of battle.

Ordinarily, when a campaign is studied, inquiry is first made concerning the forces engaged, their locations at the commencement of operations, and the position of their reserves; the roads selected for the forward movements and for the strategical concentration; the obstacles to be surmounted and the preliminary engagements preceding the battle which frequently terminates the campaign.

Next, entering upon the domain of *Tactics*, the *terrain* fought over, the order of battle adopted, the movements executed at different periods of the action, the employment of special arms of the service, the results achieved, and, if it occurred, the retreat and pursuit of the defeated army

A campaign can, furthermore, be studied by ascertaining the preparations made for it; how the troops were mobilized; how the supplies of all kinds were provided prior to the commencement of active operations, the manner of transporting them from the centers of production to the base of operations and how they were stored there; how the troops lived; how the sick and wounded were evacuated; finally, the precautions taken promptly to fill the great gaps which so rapidly occur in the *personnel* and *materiel*.

When we study one of those campaigns which have become classic, as those of Bonaparte in Italy in 1796 and 1800; or of the campaigns of 1805 or 1806; or of the campaign of 1866 in Austria, the brilliant success and the importance of the results achieved in a short time impress one. Upon more mature reflection, it is apparent that those great military and political achievements have not resulted in consequence of a caprice of fortune, but have always been preceded by most minute and careful preparation, made with great prudence, profound foresight, and a thorough knowledge of all the requirements of the armies.

That part of the art of war closely connected with *Strategy*, which alone can facilitate, or even render practicable, the most hazardous and the most successful combinations, is the administration of armies. It is the art which is charged with providing for all the wants of the troops, and which husbands their strength so that without becoming weakened by exhaustion, they are enabled to attain a distant objective, concentrate there, and finally strike a decisive blow.

To provide for the wants of the troops every army has one or more administrative departments charged with the procuration, custody, and distribution of certain varieties of supplies which are essential to keep the troops in health and strength, and which provide them at all times with everything that is indispensable for the furtherance of the plan of campaign.

In forming a plan of supply for a particular campaign the following points must be carefully considered: the resources of the theater of war and the facility of utilizing the same; the time of year and climate; the nature of the war, whether offensive or defensive; the length of the line of communications; the rapidity of the movements; the propinquity of the enemy; and the temper of the inhabitants.

The national country must provide the supplies for its armies. This is particularly important now, as it has been held that provisions and foodstuffs of ordinarily innocent use, which are usually only *conditionally* contraband, may become *absolutely contraband* of war when actually and especially destined for the military or naval forces of a belligerent.

The right of armies to take from the country all that they require for their sustenance is indisputable, though we usually understand the expression "living upon the country" has direct application to an enemy's country. Military necessity, as understood by all civilized nations, permits the enforcement in an enemy's country of all those measures which are indispensable to facilitate and assist in the conduct of the war, and which are lawful according to the modern law and usages of war.

The preparation, therefore, must extend to an elaborate study of the resources of the home country and of a probable theater of operations. In some of the great powers this work is carried out through the co-operation of the various civil authorities whose duty it is to make instant report of any change in the supply situation in their district. Statistical data and supply maps are prepared showing:

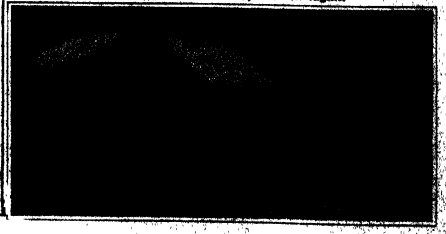
The principal production of the country; the distribution of the available resources; the importance of the last harvest; the amount of the exports of same; the amount locally consumed; the number and kind of meat cattle; the number, motive power, daily capacity, and location of the flour mills; the number and average yield of the bakeries; the number and location of the abattoirs and meat-packing establishments; the number



Foraging squad returning to camp with a drove of steers.



Forage train hauled by traction engine.



A Russian automobile military kitchen.

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of each country; the means of transportation, railways, waterways and ordinary roads, and their capacity; the number of the inhabitants, urban and rural; the character of the imports and exports; the supply and character of the potable water; the fuel used and its abundance.

In order to assure the continuity of the service of supply, that is to say, the relation between the troops in the field and the centers of production in rear of the army, the work performed by the administrative departments is divided into three distinct spheres of action, viz.:

1. The service performed in rear of the army, established in the national territory or in the governments of the occupied countries for the purpose of collecting the resources and providing means for the supply of

2. The service of the Line of Communications; the duty of the commander of which is to provide for the replacement of the stores consumed by the army, and the transportation, subsistence, and quartering of all troops, prisoners, sick and wounded passing over the line, and also provide for its protection.

3. The supply of the troops in the field during active operations.

These three services are entirely separate, but work in conjunction with each other to carry out the main object for which they are created—the supply and maintenance of an army in the field.

The success or failure of the campaign depends upon the proper operation of the service of the Line of Communications, and this important position is always assigned to a general officer of recognized ability and discretion. He is assisted by a large and numerous staff to enable him to carry out the varied and multitudinous duties assigned to him, and, in addition, has a competent force of all arms of the service to preserve order along the Line of Communications, guard the depots of supply, and protect the line from attacks by the enemy. Such officer is subordinate to the commander of the troops in the field, but his duties and responsibilities are second only to such officer.

The commander of the Line of Communications must then see that his depots are adequately supplied, and must forward each day to the troops the necessary supplies for man and horse, and likewise care for the evacuation of the sick and wounded, and the custody and care of the prisoners. To enable him to do this, all the necessary field equipments are provided; for instance, a Field Bakery Company, and equipment for each Division supplied by the Line of Communications. The Field Bakery in our Army consists of twelve knock-down bake ovens with all the necessary equipment for producing bread and the tentage in which to install the dough troughs, and shelter the men. Each oven is capable of producing 2,500 rations of garrison bread per diem, or 1,500 rations of field bread; this is bread produced in such manner that it has not as great a "pile" as ordinary (or garrison) bread, and being baked in a much slower oven, and no loaves allowed to touch (or "kiss") is completely enveloped with a good, thick crust, thus permitting the bread to be readily shipped in wagons; and its freedom from moisture renders it possible to be kept in good condition for a week or ten days. So that each field bakery can produce daily 30,000 rations of garrison bread, or 18,000 rations of field bread, sufficient to supply a Division.

The supplies an army carries with it may be divided into two classes: those carried by the troops themselves, and those which are carried in the trains.

The troops having to march many miles a day, starting early in the morning and probably not completing the march until late in the afternoon, would suffer greatly from lack of food if compelled to await the arrival of the train carrying the same. Therefore it follows that, if troops are to be fed in the field, they must carry rations with them, and the ration consumed during the day must be replaced by the train at night.

A ration is the allowance of food for one person for one day, and comprises various articles termed components It is interesting to note that the Turks in the fourteenth century first established the allowance of a soldier's daily ration, and in the same century first had regularly organized supply trains to follow their troops

Each man carries two days' rations, and the unconsumed portion of the day's ration issued the night before, for the noonday meal.

The transportation attached to organizations is grouped under the following heads, i. e.:

(*a*) The trains assigned to organizations smaller than a brigade, designated combat and field trains, respectively. The ration section of the field train carries two days' field, one day's reserve ration, and for each animal two days' grain ration

(*b*) The trains assigned to divisions, designated ammunition, supply, sanitary, and engineer trains, respectively.

The supply train of an Infantry Division carries two days' field and grain rations. In the late afternoon or at the end of a march or close of a combat, the division commander directs the *field* trains to move up immediately in rear of the troops, and informs the commanding officers of organizations that one day's rations have been ordered to a designated place. An orderly is sent to that place to conduct the wagons to the organization; after being unloaded they return immediately and join the grouped portion of the ration section. That same night, or early the following morning, the empty wagons are refilled from the supply train, and this latter secures a renewal of its supplies from a designated point on the Line of Communications, or is reloaded from a train pertaining to the Line of Communications, if the distance from the end of that line to the zone occupied by the troops is so great as to warrant the use of a train.

There are two methods of supplying an army in the field:

1. By consignments of supplies forwarded by the service of the Line of Communications and distributed as above briefly indicated; and

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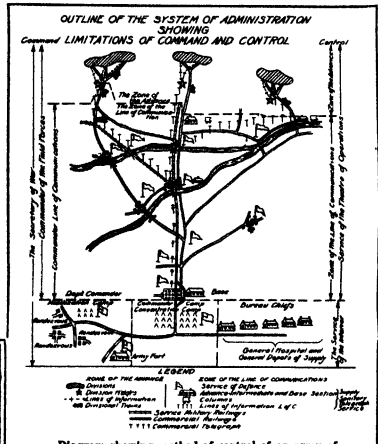


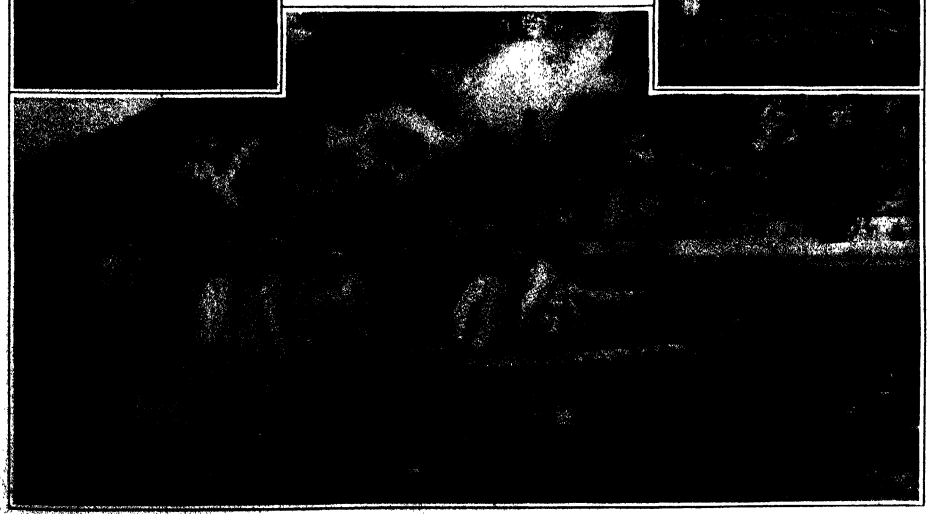
Diagram showing method of control of an army of 100,000 men in the field.



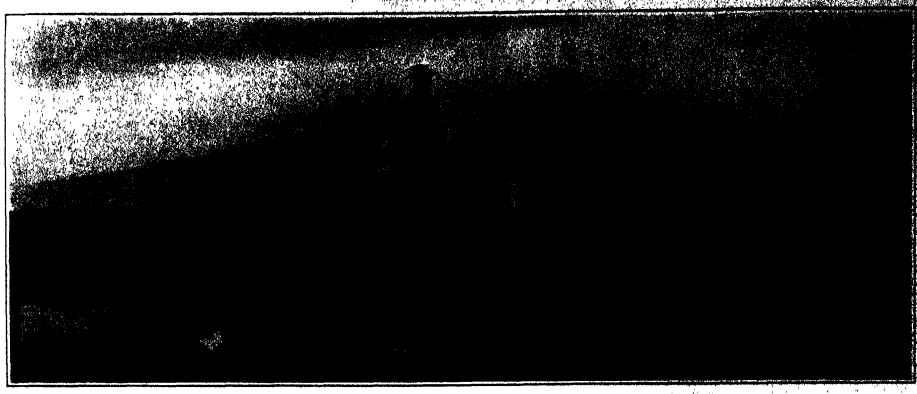
Mixing the dough for army bread.



Canvas storage tent for army bread.



Bake ovens of German Commissary Department. Capacity, 16,000 loaves per day.



Flashing messages from a heliograph station. Maximum range in clear weather, eighty miles.

The Nerves of an Army

How the Commander-in-Chief Sees and Controls a 100-Mile Battle Line

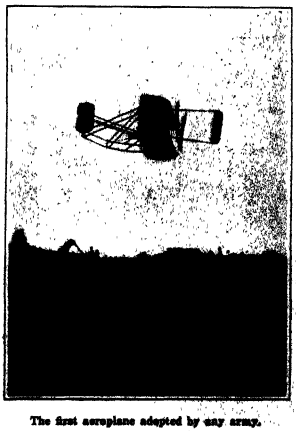
BY law and regulations the function of the Signal Corps in our Army is defined to be "the collection and transmission of information for the Army by telegraph or otherwise." In comparison with other arms, it may be said that while the cavalry, artillery, and infantry are the bones, sinews, and muscles of the body militant, the Signal Corps is its nervous system.

The harmonious action of all parts of the military machine depends primarily on the quick and precise delivery of information and orders, and it is upon lines of information that a commanding general depends to carry this information from the units of his force, and to return his orders to them. These lines are the means by which military information is transmitted, whether by wire telegraphy or telephony, radio-telegraphy, visual signals, messengers, or aeronautical craft.

Modern war involves the employment of huge armies distributed over an extensive terrain. With long-range and rapid-fire weapons has come a necessary dispersion of troops, and the consequent extension of the lines has threatened the efficiency of command by the general, and made increasingly difficult that unity of action so necessary to the successful employment of his forces. The adoption of neutral-colored uniforms and the concealment afforded by modern means of intrenching make still more difficult the delivery of orders by staff officers and messengers. The apparent emptiness of the modern battlefield has been frequently remarked by observers in recent maneuvers and wars. Under present conditions in warfare, it may be said therefore that the speedy transmission of information, a prompt decision on its receipt, and celerity of movement are more than ever necessary. The space and time factors have greatly increased in relative importance. It devolves particularly on the Signal Corps to provide for this speedy transmission, and this is accomplished by the use of electric communication in the field. The telegraph and telephone have become so much a part of our daily life in business and personal relations, that we scarcely realize our reliance upon the service rendered by the elaborate system of wires, apparatus, and well-trained personnel. To reestablish as far as possible such service under field conditions, is one of the objects of the Signal Corps. It is obvious that, under such conditions, an entirely new line of equipment is required, and that men must be specially trained to use it.

In providing proper organization and supplies for military lines of information, the work to be performed may be considered as divided into three classes. First the maintenance and operation of such lines from the Capital of the nation to the headquarters of the Army in the field; second, the construction, maintenance and operation of radio-telegraph stations and semi-permanent telephone and telegraph lines from the headquarters of the Army in the field forward to the various divisions at the front, also the provision of the necessary camp telephone and telegraph lines within the Army; third, the establishment of the temporary lines in the combat zone included within the active field operations of the divisions, consisting largely of insulated wires laid on the ground and the radio-telegraphic and visual signal communication for tactical purposes.

In the first class named, most of the equipment required would be that taken over from the commercial telegraph systems, which under stress of war conditions, at least in part, would have to be manned and operated in the interest of the nation. A military organization and control would be substituted for the civil one, and the ordinary telegraph apparatus, either land lines, cable, or radio, would be used. The Signal Corps soldiers in this zone of operations could be quickly recruited and organized from the operators and linemen of the country, and they would require but little preliminary military training. As the systems would be in territory well back of the theater of field operations, the established roads and railroads would simplify problems of transportation and supply.



The first aeroplane adopted by any army.



Two-arm flag semaphore signaling. Rapid method for short distances.

In the second class, viz., communication from field headquarters to the front, the work performed is in territory where recent military operations make it necessary to organize and equip for conditions quite unlike those for electrical communication in peace times. The wire lines must, in general, be hastily built with light wire supported on temporary small poles called "lance poles," and the radio apparatus must be of a portable variety. Telegraph apparatus employed on high resistance and poorly insulated wire is of the special type which has been developed in our service, requiring only a few dry cells for operating over long and difficult lines. A very compact and portable form of camp telephone has been devised to meet the requirements of rough field service; also a folding type of telephone switchboard of great ruggedness and simplicity for use in field headquarters and camps. All this equipment of light poles, wire, and instruments has been divided up into proper proportions for the different requirements, and special wagons have been provided to insure its transportation in accompanying the field army or divisional headquarters. The officers and men designated for this work are organized into Telegraph Companies and Telegraph Battalions. The sections of these companies are each equipped and drilled to install a well-defined part of the system. The telegraph section can establish and operate a certain amount of line with the stations thereon. The telephone section is equipped to put in a camp central station with the wire and telephones for a large camp. The officers and men of the telegraph battalions must be well trained, not only in their technical, but also in the soldierly duties pertaining to active field service. As at present authorized, a telegraph battalion in our service consists of two companies, each composed of six sections, three of the sections being equipped for telegraph and three for telephone installation. The company consists of four officers and one hundred and thirty-nine men. A telegraph section requires two wagons, and a telephone section three, for its technical equipment.

A class of duties falls to the lot of the Intelligence Service troops serving in the zone in front of the divisions, that requires an entirely special equipment. To them is assigned the task of maintaining lines of information during action, hence these have been called "tactical" or "combat" lines. The wire lines consist of insulated wire laid on the ground, but it is only such lines that can be laid and kept in touch with the rapidly changing phases of the conflict. As each infantry brigade and the artillery goes into action, it is followed by a reel cart laying wire from division headquarters. The strong flexible wire employed is a combined one of stranded steel and copper, and can be laid from the cart at a gallop, and subsequently taken up on the drum by means of a [illegible] motor. For emergency use and over short distances, a much lighter wire can be laid from a hand reel. Tactical wires

...ance, and frequently leaky, a special instrument known as the buzzer has been developed for sweeping over them. This remarkable instrument, which was largely developed by our own Signal Corps, contains in a metal-lined leather case, a small dry battery, induction coil and interrupter, key, telephone receiver, and telephone transmitter. When the key is pressed, the interrupter operates, and sends out from the coil an alternating current, which traversing the line and distant telephone receiver gives out a sharp note. The intermittent current produced by the sending key, becomes the dots and dashes of the Morse alphabet. By pressing a button on the side of the instrument, the instrument at once is transformed into a field telephone. Owing to the sensitiveness of the telephone receiver, the intense buzzing sounds sent out as Morse telegraph signals are audible over an incredible leak line. For example, it has been worked successfully over twenty miles of bare wire laid on the ground in rainy weather. It can be made to work over a wire which has been broken, and the ends left lying fifty feet apart on damp ground. The whole apparatus is confined to practically the size of a field-glass case, and weighs about five pounds, rendering it readily portable by means of a strap over the shoulder. It is the ideal instrument for field telegraphy or telephony over the combat lines laid by the reel cart.

In addition to the need for communicating from division headquarters to the infantry and artillery brigades, the divisional cavalry requires means for reporting back what its patrols and scouting parties ascertain. It would be inadvisable to hamper the divisional cavalry's movements with wire connections of any kind, so the light field radio pack sets have been devised to accompany the swiftly moving cavalry. In addition, near division headquarters, a more powerful radio set in a special pintle-type wagon, is always ready to set up and communicate with the cavalry pack set or others. The radio pack set, as developed by the Signal Corps for our service, consists of three main parts—the operating chest, the hand-rotated alternating generator, and a sectional mast with the aerial wires, or antenna, attachment. The whole outfit, with tent and accessories, makes moderate loads for and is carried on three mules. With easily manipulated strap attachments, the set can be made ready for use by the mounted section in one minute from the time a halt is ordered. This includes unpacking, putting up the sectional forty-foot mast, attaching the operating chest, and getting the hand-power generator connected and sending started. The little generator develops about 0.3 kilowatt, and the range of operation with another similar pack set is about twenty-five miles under ordinary conditions.

The wagon type of radio apparatus derives its power from a gasoline engine, the alternator develops about two and one half kilowatts, and a sectional mast eighty feet high is employed. This can be put up and the set operated in fifteen minutes. The range under ordinary conditions is about one hundred and fifty miles.

In addition to electrical equipment, the Signal troops serving with the division are supplied with signal flags, heliographs, and acetylene lanterns for day or night visual signaling. The larger signal flags are used to transmit messages by the "wigwag" system, white with a red center for use against dark backgrounds, and red with a white center when signaling against the sky or light background. The groups of right-left-front signals correspond to letters, and with a powerful glass may be read at distances of ten miles. The small semaphore flags are used in the hands in pairs, and as the combinations in positions are simultaneous, signaling is performed at considerable speed, but owing to the small-sized flags, only over comparatively short distances.

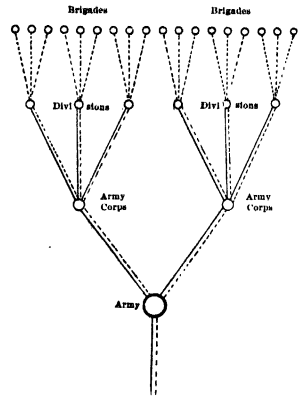


Diagram showing method of gaining intelligence and sending orders between the fighting line and headquarters of an army during an engagement. Dotted lines are buzzer or telephone; full lines, telegraph.

The heliograph consists of either one or two small mirrors mounted on a strong tripod, and by means of screw adjustments may reflect the light of the sun to the distant station in any direction desired. With the instrument adopted in the Signal Corps, the reflected rays are controlled by a shutter made up of movable blades, operated with a key like a telegraph key and mounted on the tripod. The long and short sun flashes, which may thus be sent, correspond to the dashes and dots of the Morse code. With the four-inch square mirror used, signals have been sent eighty miles. The disadvantage of the heliograph is that it depends upon sunlight being available at both stations.

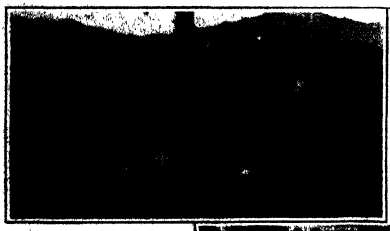
The acetylene lantern is, in effect, a small acetylene searchlight like those used on automobiles. The lantern is mounted on a heliograph tripod. By means of a tiny pilot flame, the main acetylene jet is lighted when a key is depressed. The flame is extinguished when the key is raised. Thus flash signals may be transmitted similar to those sent by the heliograph. The range of this small lantern is about twenty miles on a favorable night.

The organization which employs the appliances just described in the zone of divisional operations, is called the Field Battalion. This is made up of two companies, one called the Wire Company, the other, the Radio Company. The first consists of four sections, each equipped with a wire cart, field wire, buzzers, and visual signal apparatus; the second of three pack radio sections and one wagon radio section, using the types of field radio apparatus described; it is also supplied with visual signal apparatus. Each company has three officers and seventy-five men.

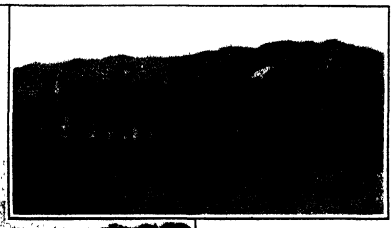
An entirely new and absorbingly interesting field of work has been opened up for the Signal Corps in aviation. The Signal Corps has long been charged with the balloon work of the Army, and quite recently an act of Congress has been approved which adds to the Signal Corps an aviation section of two hundred and sixty men. Sixty officers may be detailed in this aviation section from the line of the Army. It is to be hoped that the impetus this favorable legislation will give military aviation may awaken interest and secure a vast expansion which this highly important new aid to the art of war deserves.

The United States secured, through the specifications put out by the Signal Corps in 1907, the first military aeroplane in the world. The biplane turned over by the Wright Brothers in 1909, after the final cross-coun-

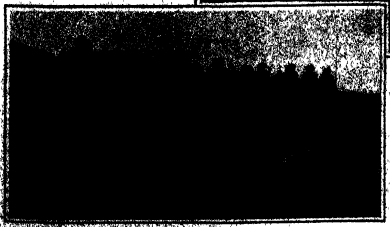
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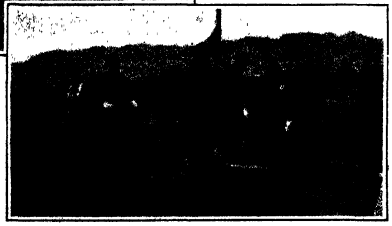
Field buzzer station receiving message over field wire laid from reel cart. The field buzzer was invented to operate over leaky wires of high resistance, such as are paid out on the field of battle from a hand reel. The instrument can also be used as a field telephone.



A radio pack section, repacking the outfit, preparatory to an advance. These light packs have been devised to accompany swiftly moving cavalry. It would be inadvisable to hamper divisional cavalry's movements with wire connections of any kind. Hence, the radio pack's reason for existence.



Operating and generating parts of a 2-kilowatt wagon radio set. Note 80-foot mast. This apparatus is carried in a special type of pintle wagon and is always ready to set up and communicate with the cavalry and other pack sets.

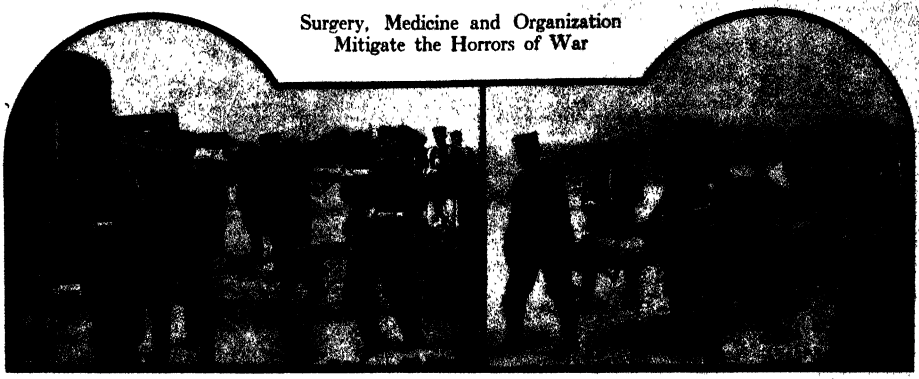


Radio pack section. Packs removed. Sectional 40-foot mast is being erected.

Buzzer station laying line over reel cart. Note portable telegraph key.

From Fighting Line to Hospital

Surgery, Medicine and Organization Mitigate the Horrors of War



Hoisting wounded into a German ambulance.

German stretcher bearers bringing in a wounded soldier.

MILITARY sanitation, the service devoted to keeping the soldier in health, has received little attention from the general public. It is closely related to the health problems of civil communities. Military conditions have afforded opportunities for striking demonstrations of the possibility of controlling yellow fever, malarial fever, and typhoid fever, so that there is good ground to hope that in the future armies need not be decimated by disease.

The plans and organization of the strictly medical service of armies, which cares for the sick and wounded, are seldom discussed. The public in general are content to dismiss the subject with some general statement to the effect that sick and wounded soldiers, especially in war, should have every comfort which money can buy; that nothing is too good for those citizens who risk their lives in its defense. The sentiment which prompts such a statement is most commendable; the manner in which it is put in practice may well be most thoughtfully considered, in order that in case of war there may be intelligent co-operation between the Medical Department of the Army and the great body of the people who are anxious to render assistance. There must be a complete and definite understanding as to what is to be accomplished, the means available for its accomplishment, and the limitations under which the work must be conducted. The latter consideration is of prime importance, for it must be constantly borne in mind that the medical service is at best but a minor accessory to a great machine, the purpose of which is to win battles.

The most elementary study of the subject suffices to show us that any army which attempted to maintain with its troops at the front a medical service sufficient to render immediate aid to all the wounded in a great battle would be submerged by the personnel and equipment required. Aggressive action would be a physical impossibility. Our greatest military authorities tell us—and history confirms the statement—that victory is won by the army which has learned to campaign with a minimum of baggage, which can move rapidly, and concentrate its strength quickly on the enemy's weak point and deliver the decisive blow before the enemy has an opportunity to reinforce the vulnerable spot. The army which is rendered cumbersome by the abundance of its supplies and which dissipates its energies in guarding its wagon trains is an easy prey for a mobile opponent.

The old hunter can be identified by the meagerness of his kit. He has learned by experience how few articles are worth their weight and the room they require in the field.

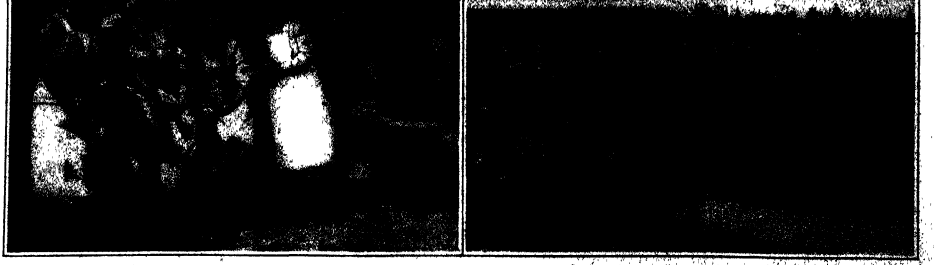
Volunteer soldiers, individually and collectively as armies, are particularly prone to burden themselves with equipment of all kinds, most of which they later discard as worthless impedimenta.

Assuming, then, that supplies of all kinds are abundant and that the matter of economy does not enter into the consideration, would it eventually prove a kindness to equip an army for campaign with everything necessary to supply its men so far as possible with the comforts to which they are accustomed at home, or, on the other hand, is it true that war, from its very nature, requires a temporary reversion to those more primitive conditions in which the needs of the individual are few and simple? The latter assumption is accepted by the medical department as the basis for constructing its scheme of service with the troops on the firing line. A thorough understanding of this basis and the necessity for its adoption is essential to an intelligent discussion of the plans for caring for the sick and wounded.

From the standpoint of military efficiency, the ideal army would be one in which every man carried a rifle, and unhampered by personal equipment was able to devote his entire energies to the purpose of defeating the enemy; similarly, the ideal medical service for such an army would be one which, without encumbering the fighting forces with supplies, equipment, and non-combatant personnel, would appear on the battlefield at the desired moment, render first aid to the wounded and whisk them away in fairy-like manner, out of the zone of combat, to a place where all the comforts of civilization and all facilities for their treatment and the best medical and surgical skill obtainable are at hand.

Absolute realization of these ideals, either for an army or for a medical service, is, of course, unattainable. An army must have a supply service, a telegraph service, and a medical service, operated by men who do not carry rifles and who are unavoidably an impediment; but their presence is justified by the purely military advantages which the army gains by their services. Thus, it is universally conceded that the *morale* of troops is improved by the knowledge that they have with them even a very limited number of medical attendants. Every military leader desires, of course, to provide his men with every comfort which it is practicable for them to have without impairing to an unwarranted degree the fighting power of his army, and each desires the most efficient medical service it is possible to obtain with a limited allowance of personnel and equipment.

The general system adopted for providing a medical service is practically identical in the armies of all the great powers. It contemplates a division of the service into three portions: that which belongs to and accompanies the fighting troops; that which pertains to the base (of supplies) and the line of communications; and that which pertains to the home territory or "the zone of the interior." The principle governing these services is that nothing but first aid and emergency treatment should be attempted in the immediate zone of combat, and that having received this treatment, the disabled should be quickly transported to the "base," where abundant facilities for their care can be provided without encumbering the fighting forces. Here at the base they are carefully classified and those who are so seri-



Red Cross nurses at the army kitchen.

German medical corps in the field.

ready declared so to be unfit for further service at the front are sent back to hospitals at home, while those who are less seriously disabled are retained until they are well enough to leave the hospital, when they are transferred to the Convalescent Camp. Here they remain until they have fully regained their strength, when they rejoin their regiments at the front.

The accompanying diagram shows schematically three brigades of infantry in line, with some artillery between them and slightly in the rear, and some cavalry on either flank. These troops, with their engineer, signal corps, and sanitary troops attached, constitute a Division, which is the great tactical unit of our army, so equipped that acting independently it is an effective unit. The sanitary troops of the division are of two classes, those which pertain to the regiments and accompany them into battle or wherever they go, called "regimental detachments," and those which remain slightly in the rear, under the command of the Division Surgeon, called the Field Hospitals, Ambulance Companies, and the Reserve Medical Supply. Each Ambulance Company is equipped to establish one Dressing Station, which is usually located as near the firing line as it is practicable to take the ambulances. The Field Hospitals are located three miles or more behind the firing line, well out of the range of fire, and usually where suitable buildings can be utilized, though each field hospital equipment includes tentage which can be used when needed. The ambulances of the division then ply between the dressing station and the field hospital. In advance of the dressing stations are seen the regimental aid stations, one established by each regiment. The ambulance company operates not only the ambulances but a detachment of thirty or more litter bearers who bring back the wounded from the regimental aid stations to the dressing stations. Each regiment of infantry is allotted four surgeons and twenty-four enlisted men of the hospital corps, and before a battle the band, probably aggregating about twenty men, is ordered to report to the senior surgeon, to act as litter bearers. About fifty-four men are thus provided for duty as litter bearers and to render first aid. Of these, four are non-commissioned officers, who take charge of the several groups into which the men are divided, four are assistants to the four surgeons, and about four additional remain with one of the surgeons at the dressing station. There are thus left about forty-two men, or twenty-one litter squads, to bring the wounded back to the regimental aid station. This is about one litter to every seventy-five men on the firing line; losses for individual regiments may be estimated at from 5 per cent to 30 per cent.

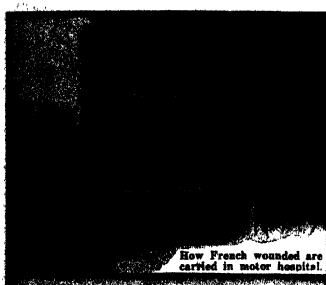
The three surgeons, in addition to the one in charge of the regimental aid station, are assigned one to each of the three battalions of the regiment—one surgeon to about five hundred men.

These proportions are not greatly different from those allowed in European armies, considering differences in organization. France and Germany each allow six medical officers to a regiment, Italy seven, and Austria-Hungary five; but their regiments are usually about three thousand strong, while ours are about eighteen hundred strong.

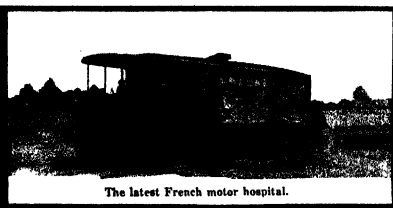
The lines of medical service on the battlefield, within the Division, have been outlined. The work at each station may possibly be best described by tracing the course of wounded men from the front to rear. Privates A and B, both of Company D, Ninth Regiment of Infantry, Third Brigade, are wounded, the former shot through the left hand and the latter through the right leg, fracturing one bone. Private A's wound is slight. He detaches the first aid packet which every soldier carries suspended from his belt, opens it, and applies one of the two bandages it contains to his wounded hand and finds the surgeon, tells him what he has done, and is given a diagnosis tag bearing his name and marked "To Station for Slightly Wounded" and signed by the surgeon. This tag serves as a pass to allow this man to go to the rear. He is perfectly able to walk, and he proceeds to the Station for Slightly Wounded, where he finds a doctor and some Hospital Corps men who have been detached from one of the Field Hospitals to establish and operate this station. Here his wound is carefully dressed and he lies down under the trees to wait the end of the engagement, when he joins his regiment. The purpose of the Station for Slightly Wounded is to prevent this class of cases from going to the Dressing Stations and Field Hospitals, which will be congested with the seriously wounded.

A surgeon finds Private B, discovers the broken bone and applies a dressing and a splint, and turns him over to a litter squad to be carried to the Regimental Aid Station, having first tied a diagnosis tag to his blouse. On arrival at the Aid Station, located in the dry bed of a stream, the banks of which are high enough to afford protection from bullets, he is placed under the shade of a tent fly and given a cup of bouillon; the dressing on his leg is inspected and found in good condition. While waiting at this station he sees numerous wounds dressed, light nourishment being prepared and served, and several Hospital Corps men come in to the Station to replenish their stock of dressings. Presently bearers arrive, and he is placed on a litter and taken to the Dressing Station. He enters the Receiving Station, is examined by a surgeon, and assigned to the Slightly Wounded Section, as he requires no further treatment at this time

(Concluded on page 192)



How French wounded are carried in motor hospital.



The latest French motor hospital.

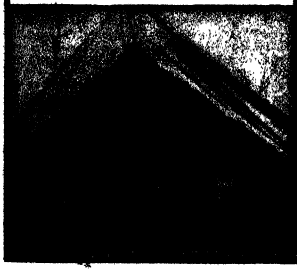


Operating table in motor hospital.

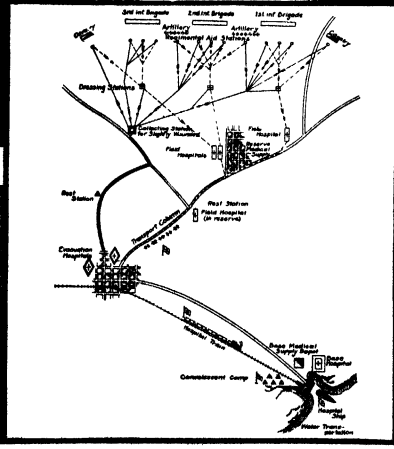


French motor hospital set up in field.

Equipment of a regimental aid station.

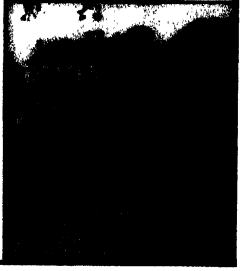


Operation tent, field hospital. Acetylene light used.

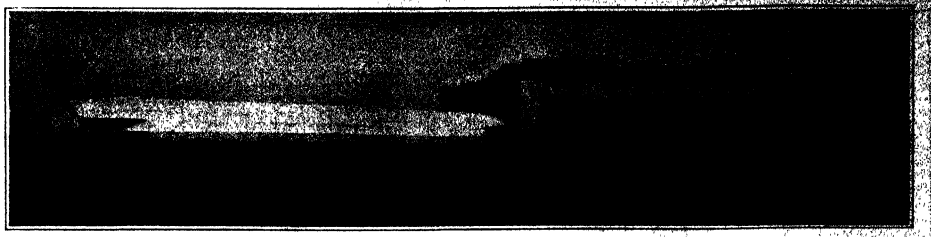


Map showing lines for return of wounded from field.

Unloading a Servian hospital train.



Man shot through foot carried by one bearer.



A Zeppelin rigid dirigible leaving the great airship shed at Baden.

Aircraft in War

How Aircraft Will Affect Strategy; the Air Strength of Europe

ALL eyes are turned upward in the present war. For the first time in history the air will play its part in a great campaign. Within the brief space of ten years air fleets have been built by the great military powers to meet just such a contingency as that with which they are now confronted.

Hardly had the flying machine and the dirigible been made half-way practicable, when we were told that henceforth battleships, great armies, and fortifications would be useless. Military experts knew better. A flying machine or a dirigible is a new kind of fighting machine, which will merely be added to the old machines.

For centuries the main principles of war have been unchanged. The fundamental difficulties of a campaign are much the same now as when Rome wiped out Carthage and Cæsar conquered Gaul. Even aeronautics will not alter them. Seven centuries ago armies of 30,000 men clubbed, speared, piked, and hacked each other a few yards apart. At Waterloo there were 120,000 men on one side and 90,000 on the other; cannon and muskets separated the opposing forces half a mile and more. In the battle of Mukden, fought in 1904 by the Japanese and Russians, 310,000 men were engaged; the battlefront was about one hundred miles long; high-power artillery with a range of miles kept the hostile forces so far apart that most of the Japanese and Russians never saw each other. So, the dirigible and the aeroplane are new engines of war. As such they will modify the manner in which the old principles are applied. The principles themselves will not be changed.

What Will Be the Effect of Aerial Reconnaissance?

No one can tell exactly how efficient aircraft will be in the present war. But it is certain that battles must be more carefully planned. The cavalry raids which marked our Civil War, the hidden movements of a mobile force, so well handled that it could even defeat larger numbers, will be quite impossible, simply because they will be detected by the aircout. Modern armies are so huge that they cannot easily be rearranged after their "strategical deployment," as it is called, has once been decided upon. Hence the use of aircraft will develop farsightedness in the preliminary disposition of troops and bring about a general speeding up of strategic operations. Because of the eye in the air, opposing army corps will become more like naval squadrons; their presence and strength will be revealed to each other, as the presence and strength of battleship fleets are revealed at sea. With positions, strengths, and movements known, it is evident that a new strategy must be developed. Great mobility and great numbers will count for more than ever before.

With cards thus of necessity all laid on the table, we may expect more merciful preliminaries than in the past. Before the days of the airship and aeroplane a general had to feel the enemy's strength. He sent out skirmishers and cavalry, whose losses were the only test he had of the strength and position of his foe. Even then he might be fooled by feints, by masked movements. At Mukden the Japanese caused the Russians to think that the Russian right flank would be turned. Reserves were hurried east to counteract the expected movement. Countermarching westward, they could be thrown only piecemeal against the true Japanese flank attack. The result can be imagined. Suppose that the Russians had commanded the air. Suppose that they had discovered the actual movements of the Japanese reserves and met flank attack with outflanking movement. What a different battle it would have been!

Waiting for the Air Scouts' Reports.

Because he has aircraft at his disposal a modern general will be more apt to await the results of their reconnoitering before giving final orders. In other words, there ought to be fewer counter orders in present European engagements than during the Franco-Prussian War. There is too big a risk of moving troops in the wrong direction. It is estimated that within 3½ hours a general may expect an air report of his foe's strength, position, and movements if he is within a radius of 80 miles. If cavalry alone were used for the same purpose probably three days would be required, and the information collected would not be so precise. Three and one half hours is not too long to wait before giving a definite order, which may result in victory or defeat.

Reconnaissance is of two kinds—strategical and tactical. By strategical reconnaissance we mean the observation of main bodies, in column of route, for example. In tactical reconnaissance troops must be observed after they have left the roads—a difficult task because the troops are harder to find, and it is not easy to estimate their strength. It is evident that there will be more tactical than strategical reconnaissance as the strategical merges into the tactical phase. Hence, the greater number of flights as armies engage will be short flights for tactical reconnaissance which will result in placing information immediately in the hands of a commander.

Will There Be Battles in the Air?

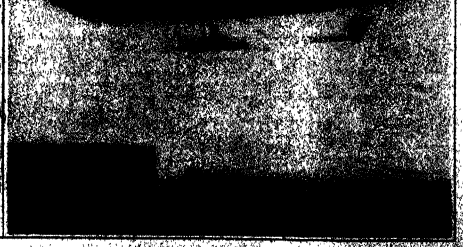
Since all the great powers now engaged in war have aeroplanes and dirigibles, battles will not be aeronautically one-sided. Both dirigibles and aeroplanes of some types carry guns. Some attempt will be made to fight off an aircout. How serious the attempt will be no one knows. The personal risk of an encounter is so very great that it may be questioned if it will be lightly taken. Fighting with a rifle or machine gun at an elevation of a mile is obviously perilous. A clipped control cable, a fractured wing spells death. Is our twentieth century courage equal to such a fight in the air?

Bomb-dropping, too, is to be tried out on a large scale. How destructive large quantities of explosives dropped from dirigibles can be no one really knows. The censors have not allowed the press of the world to state whether or not explosives were dropped on the fortifications of Liège. If they were—and it seems likely that some effort in that direction may have been made—the destructive effect could not have been great in view of the forts' stubborn resistance.

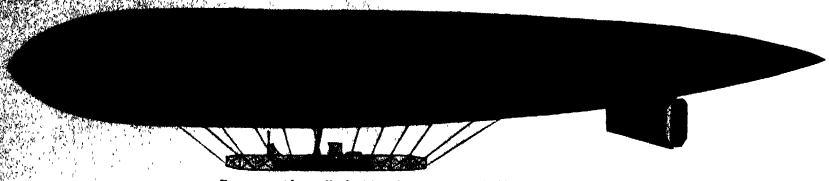
After all is said, the aircraft of the warring powers are more likely to be used for reconnaissance than for any other purpose. To reconnoiter speed is necessary for less obvious purposes than the covering of great distances in a short time or escaping an attack. In a high wind only the high-powered flying machine can be used at all. That was conclusively proved in the last Army Exercises of Great Britain. The weather was continuously bad. Low-lying clouds rendered observation impossible from a height exceeding 2,500 feet (dangerously low because of the chance of being hit from below), while high and gusty winds prevailed. Some of the aeroplanes used were biplanes of a relatively slow type, with a maximum speed of 55 miles an hour. When the wind attained a velocity of 30 miles an hour, the slow biplanes were unable to accomplish any effective work. True, they ascended; but their speed, being insufficient to allow them to make any headway against the wind, they were unable to attain the enemy's lines, which were distant only a few miles. On the other hand, the swifter machines were never



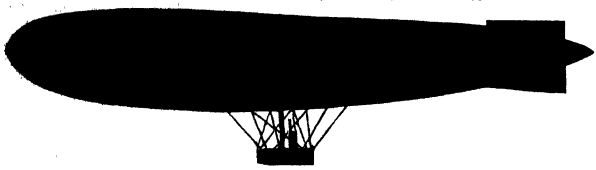
Car of a Clément-Bayard airship of a type which is still in commission, but which has been greatly modified.



The Clément-Bayard V, which once held the altitude record for aeroplanes (2,500 meters). The type is not unlike the German Parseval.



France must be credited with at least eighteen airships of various types.



If England's programme can be carried out by the end of the year she ought to have fifteen dirigibles in service. As it is she can rely on only seven.



Russia has probably not more than three airships available.



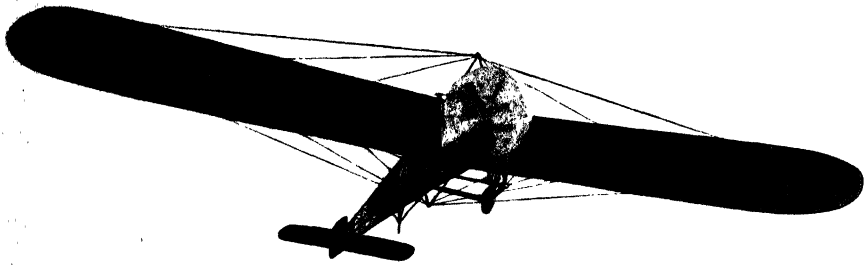
Belgium has one airship.



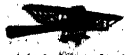
Austria has not less than three nor more than five airships available.



Germany can put into the air twenty-three airships of the rigid, semi-rigid, and non-rigid type.



The French Army has at least 500 aeroplanes at its disposal in the present war.



Austria has at least 50 aeroplanes.



England has about 250 aeroplanes of all types.



Russia has 50 aeroplanes.



Germany is about the equal of France in aeroplane strength. She has 500 flyers.

THE AIR STRENGTH OF EACH NATION IS SUPPOSED TO BE CONCENTRATED FOR PURPOSES OF GRAPHIC COMPARISON, IN ONE HUGE DIRIGIBLE AND ONE HUGE AEROPLANE

idle. They flew day after day, regardless of wind and weather. The lesson is obvious: Slow machines are worthless for all conditions of field service.

Speed is the Governing Factor.

There was a time when aeroplane speed was subordinated to durability and strength. But in those days (three years ago) aeroplane accidents were more frequent than they are now. It was thought then that biplanes would be employed exclusively for military purposes because of their stancher construction. Indeed, there was even an understanding if not an actual rule in the War Offices of the European Powers that biplanes were to be ordered in preference to monoplanes, All that seems to have been changed. Both types of machines are to be found in use. Monoplanes are stanch enough to withstand extraordinary strains, as the looping performances of Pégoud and his imitators have abundantly proved. The main consideration is that of speed; slow machines cannot be used nowadays, in other words, machines that travel at speeds of less than fifty miles an hour. The policy of the French army is a good case in point. Between 1912 and 1913 orders for the faster Henry Farmans increased by 300 per cent, while those for the slower Maurice Farmans decreased by over 30 per cent As soon as Maurice Farman increased the speed of his machine by relegating the elevator to the tail and making other improvements it was restored to army favor. The armored machine, too, is much sought after. In 1912, for example, only eight Voisins were ordered As soon as Voisin produced his steel, 70 mile an hour machine, an order for thirty-one was promptly placed.

The Rôle of the Airship.

While the aeroplane has proved its utility both in the Morocco and Balkan campaigns, the dirigible is still a military enigma. The operations of European armies during their annual maneuvers are shrouded in a veil of secrecy as dense as if the forces were engaged in real war. Germans and Frenchmen shrink from publishing the results of their military experiments for each other's benefit. Great Britain is less secretive. Her last Army Exercises, which were fully reported and analyzed in the London press by competent military men, demonstrated conclusively that the slow, non-rigid dirigible is certain to be destroyed should it attempt to take part in daylight warfare. Speed alone can save it, but speed imposes prohibitive size and power for that type of craft The lesson is clearly taught by the evolution of the rigid type. The Zeppelin built in 1906 had a volume of 430,000 cubic feet; that of 1911, 627,000 cubic feet, the first naval craft wrecked off Heligoland, 776,000 cubic feet; and the second naval Zeppelin, "L 2," 950,000 cubic feet. Still larger vessels are in course of construction. Speed has increased correspondingly from 36 miles an hour in 1906, to 52 miles an hour in 1912, and over 60 miles an hour in 1913. The very latest type has an average speed of about 65 miles an hour, and has made as much as 94 miles with the wind. In other words, the latest Zeppelins compare favorably in speed with the fastest army aeroplanes. The vast radius of action of the Zeppelins, both new and old, enables them to work from bases far from the scene of operations. Recognising that fact, and evidently planning to use Zeppelins in that way, Germany has constructed a large number of "airship harbors," with sheds mounted on turntables. France has similar harbors, less elaborately equipped, but without turning sheds.

The Zeppelin and Its Possibilities.

From the practice which the crews of Zeppelins have had in handling guns and bombs while in the air, it is evident that Germany intends to use her Zeppelins as real fighting battleships of the air. That the machine guns may prove serviceable in beating off attacks from aeroplanes is generally conceded; but on the effect of high explosives dropped overboard by the hundredweight, opinion is divided. While the moral effect must be huge, it is contended that the actual damage that can be inflicted must be small. If it is true that explosives were dropped from Zeppelins in the heart of Antwerp, the actual loss of life that resulted and the damage done were not as great as might be expected. It is reasonable to suppose that trials have been made with dropped explosives before committing the Zeppelins to this new method of attack. The fact that a dirigible can hover stationary over a given spot simplifies the problem of hitting the target from a height of a mile and a half.

While we hear much of the terrible bomb-dropping possibilities of airships, both rigid and non-rigid, we are apt to overlook one enormous strategic advantage of the airship over the aeroplane, and that is its ability to travel safely and surely at night. As yet we have learned nothing of the nocturnal activities of dirigibles; the Zeppelin attack on Antwerp is said to have occurred after dusk, but when the war is over or when the veil of mystery is lifted a little we may hear of airships that set out after dark, traveled with muffled motors over a fortified position, swooped down suddenly to determine the strength of a position, and rose quickly before a damaging fire could be opened. Searchlights must be used in such exploits—searchlights which, while they betray the dirigible's presence, also momentarily dazzle the riflemen.

That the rigid type of dirigible is far inferior to the non-rigid, the experiences of the last British Army Exercises showed. Two non-rigid airships were employed, both well handed. But they were slower than the slowest aeroplane, which would have meant certain destruction from machine-gun fire in time of war. Moreover, they could not ascend to any great height. On days when the wind was high they were useless, and even when the wind had dropped, hostile aeroplanes made it a point to circle around and above them. How long these non-rigid dirigibles would last in war if opposed by fast, armed aeroplanes, can be imagined. On the other hand, a Zeppelin would have a chance of escape, not only because it is armed, but because of its ascensional speed. The passenger Zeppelin "Viktoria Luise" can rise 3,600 feet in 5 minutes, and the newer military Zeppelins still faster Since the ascensional speed of an aeroplane is about one half that of the "Viktoria Luise" a Zeppelin ought to be able to seek refuge in the upper reaches of the air when it is hard pressed. The loss in gas, however, must be reckoned with.

The Air Strength of the Powers.

Germany's aerial fleet is better organized, better designed, and better equipped than that of any other European power. Her Zeppelins must be regarded as the most formidable aircraft thus far devised. But besides the Zeppelins she also has airships of other types which can hardly be considered any more effective for daylight use than the three British dirigibles which gave so poor an account of themselves in the last

(Concluded on page 192.)

GERMAN NAVAL AIRSHIPS (RIGID TYPE)

Name	Make	Date	Displacement in tons	Length in feet	Diameter in feet	Speed in miles per hour	Total horse-power
L 5 (?)	Zeppelin	1914	42 0	550	61	62	1,100
L 4	Schütte-Lanz	1914	30 0	550	61	50	1,030
L 3	Zeppelin	1914	32 0	550	61	50	720
GERMAN ARMY AIRSHIPS (RIGID TYPE)							
Z 8	Zeppelin	1914	22 0	515	49	48	540
Z 7	Zeppelin	1913	22 0	515	49	48	540
Z 6	Zeppelin	1913	19 5	465	49	48	540
Z 5	Zeppelin	1913	19 5	465	49	44	540
L 4	Zeppelin	1913	19 5	465	49	48	540
Z 1	Zeppelin	1913	19 5	465	49	48	540
Z 3	Zeppelin	1912	17 5	462	46	40	450
Z 2	Zeppelin	1911	17 8	485	46	48	450
S -L 1	Schütte-Lanz	1909-(1912)	19 0	430	60	46	540
S -L 2	Schütte-Lanz	1914	23 0	475	61	50	720
GERMAN PASSENGER AIRSHIPS (RIGID TYPE) AVAILABLE FOR WAR.							
Sachsen	Zeppelin	1913	19 5	465	49	48	540
Hansa	Zeppelin	1912	18 7	485	46	50	540
Viktoria Luise	Zeppelin	1912	18 7	485	46	48	450

GERMAN SEMI-RIGID AND NON-RIGID AIRSHIPS (ARMY)

The P airships are non-rigid and the M airships semi-rigid in the following table

Name.	Make	Date	Displacement in tons.	Length in feet.	Diameter in feet.	Speed in miles per hour.	Total horse-power.
P 4	Parseval	1914	11	280	50	47	360
P 3	Parseval	1911	10	280	52	40	400
P 2 (Kreatz)	Parseval	1910	8	254	49	32	360
M 4	Gross	1913	13	320	44 5	47	450
M 1	Gross	1912	8	245	36.3	38	150
OTHER GERMAN AIRSHIPS AVAILABLE							
Veeh I	Deutsche Luftsch-Werft	1913	5	220	45	43	360
P L 6 (Stollwerck)	Luftfahrzeug G m b h	1910	4½	250	45	38	290

The Theater of the Present Franco-German Struggle

A STUDY of the adjoining map of the theater in which the most important battles, at least of the opening phases of the War of the Nations, are now being fought, shows why it was that Germany broke faith with Europe and ruthlessly entered the fair lands of unoffending Belgium, carrying with her fire and the sword!

In the first place, the most direct advance on Paris (the German objective) can be made across Belgium by way of the valley of the Meuse. The border line between Germany and Belgium is only about 175 miles from Paris, and from the Belgian frontier to Paris is about 135 miles. Through that portion of the valley of the Meuse which lies in Belgium runs one of the main railroad lines leading from the great industrial center in which lies the Krupp works, direct through northeastern France to Paris.

Of the French frontier between the North Sea and Switzerland, only one half is conterminous with that of Germany. The strategy of the German army, in the event of a conflict with both France and Russia, contemplated a concentration of the flower of the German army against the French lines of defense so swift, and in such superior force as to make sure of striking a crushing blow at the very outset of hostilities. Meanwhile Russia was to be opposed by the reserves, which, if at first outnumbered, would have the Vistula and its strong defenses to fall back upon and hold until sufficient reinforcements arrived for the eastern German armies to take the offensive.

Now, because of the treaty guaranteeing the neutrality of Belgium, to which Germany was a signatory, the French, after the disasters of 1870, concerned themselves mainly with the defense of the southerly half of their frontier, facing the forfeited provinces of Alsace and Lorraine, and they built a chain of entrenched camps, city fortifications, and interconnecting forts, which presents a practically unbroken front from Verdun in the north, opposite the Duchy of Luxemburg, to the far-famed fortified town of Belfort on the Swiss frontier. The Franco-German frontier is about 120 miles in length, and facing the border, from north to south, are the heavily fortified cities of Verdun, Toul, Epinal, and Belfort, each of which bestrides one of the most important railroads and highways leading from Germany to French soil. These cities divide the border into three equal lengths, each of about 40 miles.

The defenses of these cities are approximately similar, consisting of an outer circle of forts, spaced 2½ miles apart from each other, with a circumference of about 50 miles; back of which is an inner line of defenses and a citadel. Between the Swiss frontier and Belfort is a chain of forts, so spaced that the intervals are swept by gunfire, and a similar chain connects Belfort and Epinal, and Toul and Verdun.

The new scheme of defenses did not include the Belgian frontier, the French believing that Germany's signature to the treaty guaranteeing the kingdom's neutrality was a sure enough defense. Along that border are only the original frontier forts, Longwy and Montmedy, and the great entrenched camp, Maubeuge.

Back of this first line of forts and fortified cities, which may be considered practically impregnable to direct assault, is a second line, behind the shelter of which, should the first line be forced, the shaken armies of France could reform, and be strengthened by reserves and recruits

In the south, back of Belfort, and some 50 miles distant therefrom, is a triangle of three strongly fortified cities, Besançon, Dijon, and Langres, the sides of the triangle being approximately 50 miles. These cover the railroad from South Germany to Paris, *via* Belfort, just as Toul covers the road from Strasburg to Paris, and Verdun opposes a German advance by way of the railroad from Metz.

Some 60 miles back from the Belgian border is another line of defensive works, consisting of the fortified cities of Rheims and La Fue and an inter-connecting line of forts.

Should the German invasion break through the frontier and the intermediate barriers, there remain the two great circles of forts that surround the city of Paris. The outer ring, constructed since 1870, consists of an unbroken circle of forts and batteries measuring over 70 miles in circumference. It is built 7 miles beyond the city limits; and three miles nearer the city is the ring of famous forts that figured in the siege of Paris 1870-71. It would take an army of 600,000 men effectively to besiege modern Paris. Can Germany batter her way across France, and reduce Paris? The answer lies with the German infantryman.

In a patent, 1,104,802, Robert C. Hub of Detroit, Mich., combines a mud-guard and air-deflector with a radiator hood so that the guard and deflector operate to insure a positive circulation of air through the radiator.


MAP
Battlegrounds
Belgian Allies
Germany and Austria
HELGOLAND
Helgoland
SCHLESWIG
HOLSTEIN
FRIESIAN ISLANDS
OLDENBURG
NORTH SEA
AMSTERDAM

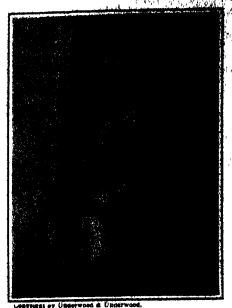


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Sir J. R. Jellicoe, in supreme command of the British fleet.

A Comparison of Naval Strength

Overwhelming Superiority in Ships and Guns Possessed by the Triple Entente



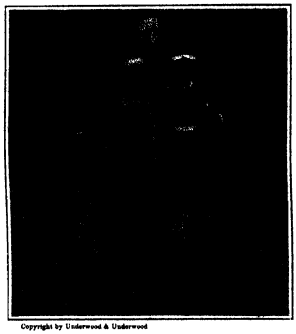
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High Admiral Alfred P. T. von Tirpitz, commander of German navy.

[It is not our purpose in the present article, dealing with the relative strength of the fleets of the Triple Entente and the Dual Alliance, to enter into the question of how far such a comparison is affected by the geographical situation. This will be done in the successive articles dealing, seriatim, with the various navies that have been drawn into the general European war. In passing, however, we may mention that the complete separation of the German and Austrian fleets, the former having retired to the Baltic and the latter to the northern end of the Adriatic, greatly weakens the naval situation, so far as the Dual Alliance is concerned; whereas the interposition of the combined British and French fleets, between the widely separated forces of the enemy, enables them to deal with the German and Austrian fleets in detail and to concentrate their own forces in overwhelming superiority for united action.—Editor.]

THE relative strength of the contending navies is told, graphically, in the adjoining illustrations and, in detail, in the table given below. With regard to the drawings it should be carefully explained that they are based upon the total tonnage displacement of the fleets engaged. This is the fairest basis of comparison; for the naval architects of the world are so well acquainted with the work of their competitors, that it is safe to say that a ton of displacement has a certain definite military value, which renders it an accurate unit for comparisons such as those shown upon the accompanying page. As between two ships of similar displacement the distribution of the weight may vary and does vary very considerably. One ship may carry more guns at the expense of armor; the other may make a larger allotment of weight to the motive power, preferring the tactical advantage of high speed to that of more guns or heavier armor. Of course, some serious mistakes have been made in the design of important ships in various navies in the world, as we shall show in a later article; but, speaking broadly, it may be said that the development of the warship in the various classes—dreadnoughts, pre-dreadnoughts, armored cruisers, protected cruisers, etc., has proceeded along certain well-defined lines, and, especially in the work of the last ten or fifteen years, there have been but few mistakes of a glaring character.

Referring again to the illustrations, it should be carefully noted that the various ships are to be compared as to length only, and that no account should be taken of the bulk of the ships compared. Thus, in the diagram representing the dreadnought strength it will be



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The Kaiser, in supreme command of Germany's navy.

seen that the larger ship, corresponding to the fleet of the Triple Entente, is twice as long as the lower ship representing the dreadnoughts of the Dual Alliance.

Attention is drawn to the fact that there is a discrepancy between the total displacement figures shown in the drawings and those given in the table. This is explained by the fact that the table, drawn up as we go to press, gives the very latest figures obtainable.

We have learned on reliable authority that Great Britain, since the declaration of war, has taken over the two powerful dreadnoughts which were completing in British yards for the Turkish government. These vessels are the "Osman I" of 27,500 tons, carrying fourteen 12-inch guns, and the "Reshadieh" of 23,000 tons, carrying ten 13.5-inch guns. This adds 50,000 tons to the total displacement of the British navy. Again, since the war opened, Germany has lost one of her latest dreadnoughts, the battle-cruiser "Goeben" of 23,000 tons, carrying twelve 11-inch guns, and her displacement is reduced accordingly.

It should be noted that this comparison takes no account whatever of ships that are not yet completed. All the great powers have under construction several dreadnoughts in a more or less advanced stage of construction, and many of them require only two or three months' work to put them in commission. Thus Great Britain has two ships of the "Queen Elizabeth" class which will be completed in six weeks' time, and two others are to be ready by the end of January next year. These are 25-knot dreadnoughts carrying each eight 15-inch guns, and they will be the only ships afloat carrying a gun of this power. Germany by October will have completed three dreadnoughts of the "Koenig" class, carrying ten 12-inch guns. France should complete this year two dreadnoughts of the "Bretagne" class, mounting ten 13.5-inch guns, and Russia should put into commission two dreadnoughts of the "Gangut" class, carrying each twelve 12-inch guns. None of these ships, however, are available in the opening phases of the war, and they will not be in line for the first shock of conflict.

At the opening of the war, then, we find that the Triple Entente has 35 dreadnoughts against 19 for the Dual Alliance—a crushing superiority, were it not for the existence of the Kiel Canal and the strong defensive position afforded by the Baltic, where the German fleet has probably taken refuge. In pre-dreadnoughts the Triple Entente has 66 ships as against 26 for the Dual Alliance. In armored cruisers, 60 to 11; in protected cruisers and scouts, 92 to 46. There is

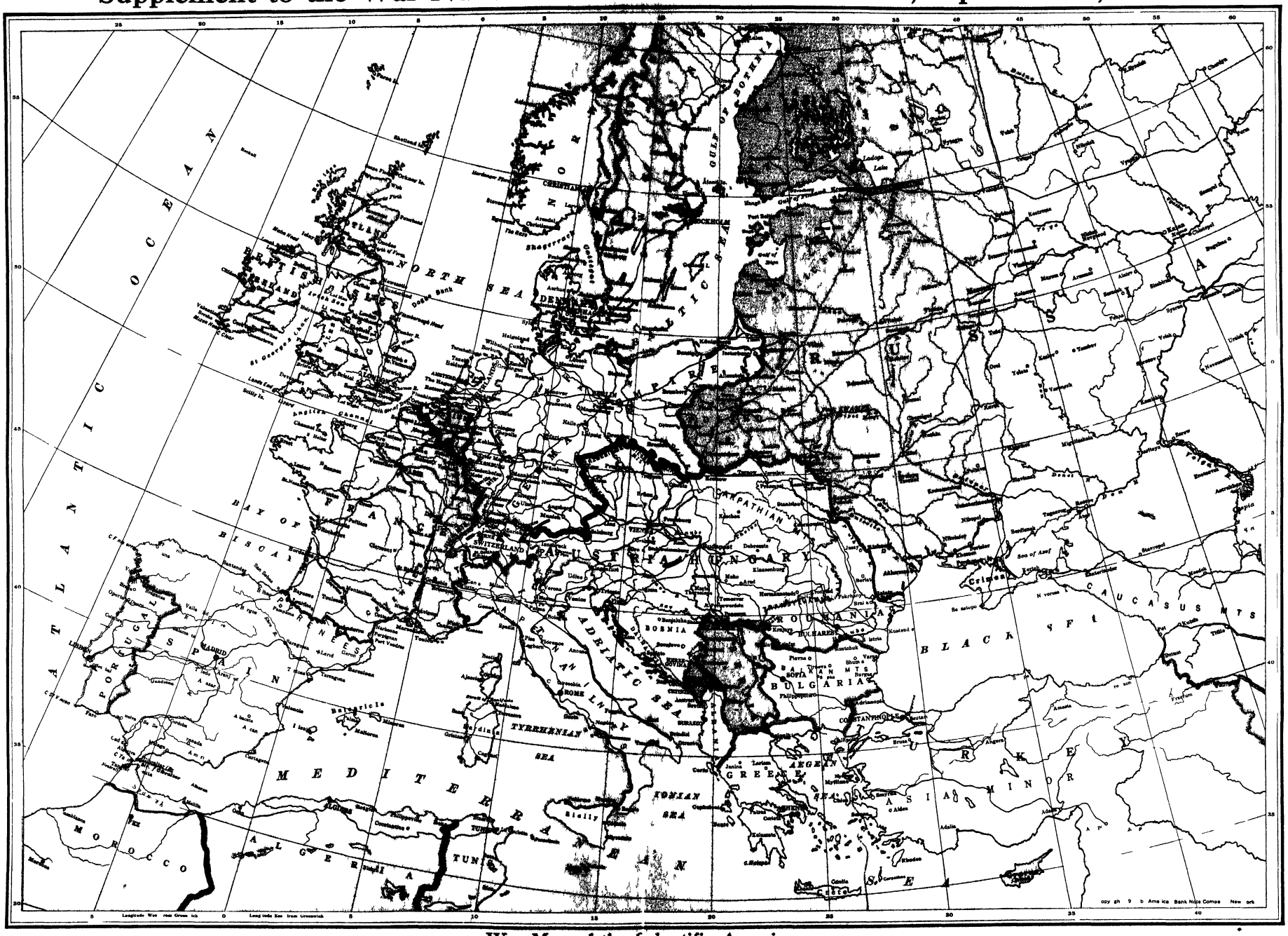
(Concluded on page 195)

COMPLETED SHIPS OF THE CONTENDING NAVIES, AUGUST 1st, 1914.
Including warships of 1,500 tons or more, and torpedo craft of over 50 tons.

RELATIVE STRENGTH OF THE TRIPLE ENTENTE AND DUAL ALLIANCE.

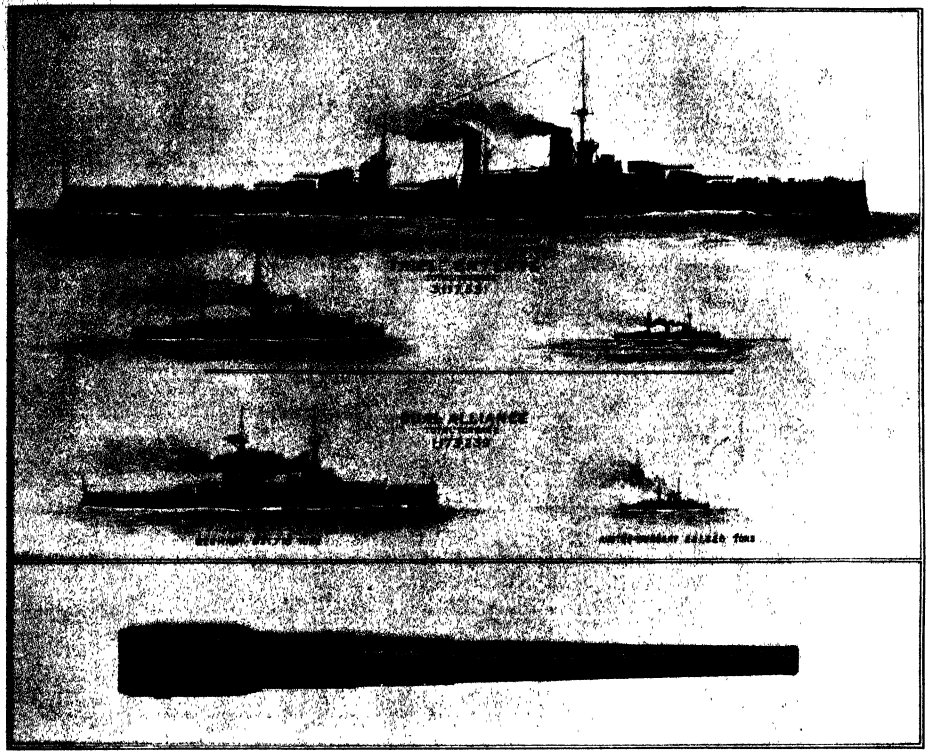
Type of Vessel.	Great Britain.		France		Russia.		Germany.		Austria.		Triple Entente.		Dual Alliance.	
	No.	Tons.	No.	Tons.	No.	Tons	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Dreadnoughts	31	661,650	4	92,368			16	351,519	3	60,030	35	754,018	19	411,549
Pre-dreadnoughts	40	589,385	18	262,675	7	98,750	20	242,800	6	74,613	66	950,810	26	317,413
Coast defense ships		....	1	8,800	2	10,380	2	8,168	6	41,700	3	19,180	8	49,868
Armored cruisers	34	406,800	20	201,734	6	63,500	9	94,245	2	13,380	60	672,034	11	107,625
Cruisers	74	382,815	9	46,095	9	52,845	41	150,747	5	13,815	92	481,755	46	164,562
Destroyers	167	125,850	84	35,812	91	36,748	130	67,094	18	9,450	342	198,410	148	76,544
Torpedo boats	49	11,488	135	13,426	14	2,132	...	.....	39	6,852	196	27,046	39	6,852
Submarines	75	30,362	64	27,940	30	6,506	21	14,140	6	1,586	169	64,906	27	15,826
Total tons completed		2,208,350		688,840		270,861		928,713		221,526		3,159,061		1,150,239

Tables showing relative strength of Triple Entente and Dual Alliance.



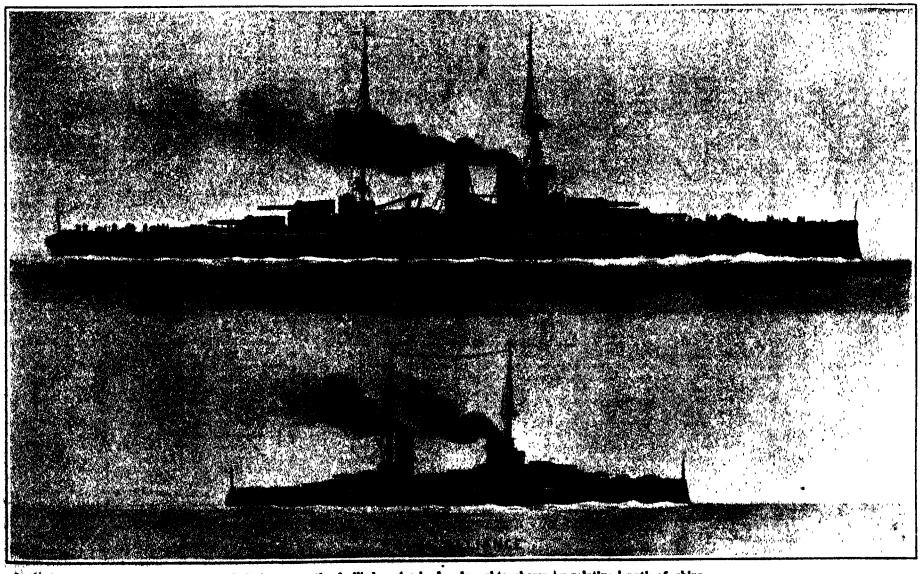
War Map of the Scientific American

The Country of the Allies is shown in green, the Dual Alliance in pink, and the Neutrals in yellow



Copyright, 1914, By Munn & Co., Inc

Relative strength of complete navies of Triple Entente and Dual Alliance, shown by relative length of ships and guns.



Copyright, 1914, By Munn & Co., Inc.

Relative strength of allied navies in dreadnoughts, shown by relative length of ships.

The Mistress of the Seas

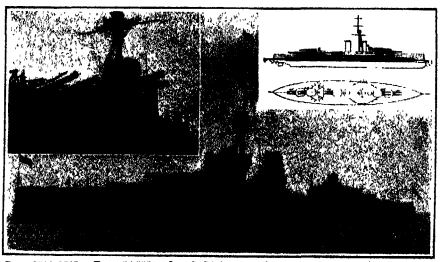


Date, 1914 Tons, 25,000. Speed, 21½ knots. Guns: Ten 13.5-inch, twelve 6-inch. Torpedo tubes, 4 Side armor, 12-inch—10-inch.

Dreadnoughts: "Iron Duke" (flagship); "Marlborough"; "Benbow"; "Emperor of India."

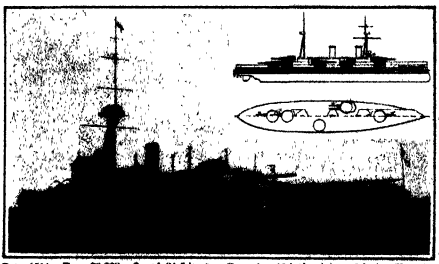
THE British fleet, composed of nearly five hundred ships of an aggregate displacement of about two and one quarter million tons, is the military force which binds together and preserves intact that vast aggregation of countries and peoples known as the British Empire. Great as it is, the British Navy is not by any means excessive; it merely measures up to the enormous responsibilities that are laid upon it So far as the British Isles are concerned, its purpose and scope are exactly the same as those, let us say, of the great German army, namely, to afford complete security from attack by hostile nations. So long as Great Britain's navy is sufficiently powerful to maintain the command of the seas, her shores can be maintained inviolate, and she can pursue her activities as a great manufacturing and commercial nation, free from the burden of those enormous conscript armies which have proved so burdensome to the nations on the continent of Europe. In this respect, the situation of the British Isles is similar to that of the United States. It is our policy, or at least it should be, to maintain a navy sufficiently strong to discourage any foreign power from sending its fleet across the sea to engage us with any hope of success.

The duties of the British navy, however, do not end with the mere protection of the British Isles from invasion; for to the navy falls the work of protecting Great Britain's enormous seaborne commerce; and hence we find that the list of her ships includes over one hundred fast and powerful cruisers, to which in the



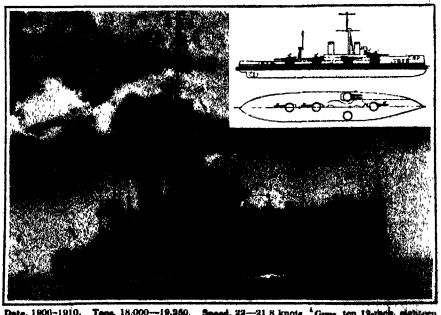
Date, 1912–1913. Tons, 23,000. Speed, 22 knots. Guns, ten 13.5-inch, sixteen 4-inch. Torpedo tubes, 3. Side armor, 12-inch, 9-inch, 8-inch.

Dreadnoughts: "Orion"; "Conqueror"; "Monarch"; "Thunderer"; "Ajax"; "Audacious"; "Centurion"; "King George V."



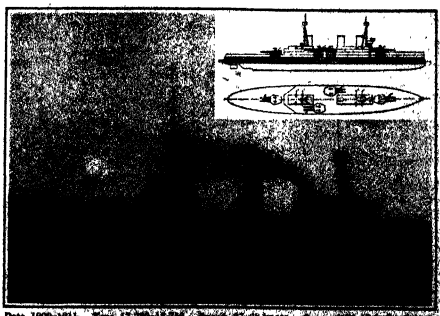
Date, 1911. Tons, 20,000. Speed, 21.5 knots. Guns, ten 12-inch, sixteen 4-inch. Torpedo tubes, 3. Side armor, 11-inch—8-inch.

Dreadnoughts: "Hercules"; "Neptune"; "Colossus."



Date, 1906–1910. Tons, 18,000—19,250. Speed, 22—21 8 knots Guns, ten 12-inch, eighteen 4-inch; original "Dreadnought," twenty-four 3-inch. Torpedo tubes, 3. Side armor, 11-inch, 10-inch, 8-inch.

Dreadnoughts: "Dreadnought"; "Bellerophon"; "Temeraire"; "Superb"; "Collingwood"; "St. Vincent"; "Vanguard."



Date, 1909–1911. Tons, 17,250–19,250. Speed, 27–25 knots. Guns, eight 12-inch, sixteen 4-inch. Torpedo tubes, 3. Side armor, 8-inch. Finish.

Battle-cruisers: "Australia"; "New Zealand"; "Indefatigable"; "Indomitable"; "Inflexible"; "Invincible."

Photos by Stephen Usher, Symonds & Co., and R. W. C. Brown.



Date, 1913. Tons, 26,350–27,000. Speed, 28–29 knots. Guns, eight 13.5-inch, sixteen 4-inch Torpedo tubes, 3. Side armor, 9-inch

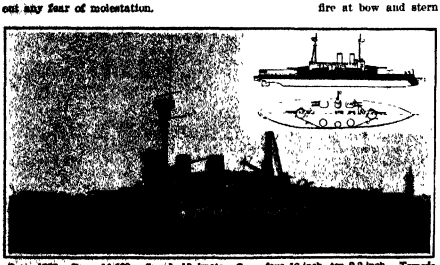
Battle cruisers: "Queen Mary"; "Lion"; "Princess Royal."

event of war falls the duty of patrolling the ocean lines of travel, seeking out and destroying the cruisers of the enemy, and making it possible for her vast fleet of merchant ships to carry her exports abroad and bring in products and supplies from foreign nations, of which latter, during hostilities, her greatly needed food supply would form the most valuable part.

Already, although the war is but a month old, not only has the German fleet been forced out of the North Sea and into the shelter of the Baltic and Germany's home ports, but the cruisers and commerce destroyers of the enemy have either been driven from the trade routes or are being so closely followed and harried, that they have ceased to be a menace to British, French, and Russian shipping. Furthermore, so secure does Great Britain feel behind the protecting arm of her fleet, that she is sending the whole of her trained army to the Continent, and making ready to follow with several hundred thousand auxiliary troops, which can be recruited, trained, and shipped to the field of war without any fear of molestation.

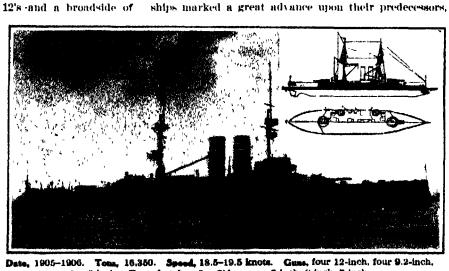
The first fighting line of the British navy is made up of no less than 31 ships of the dreadnought class, the earliest of which—the original dreadnought—is now not more than eight years old. All of these ships have a speed of from 21½ to 22 knots, and their displacement varies from 18,000 to 25,000 tons. The first seven follow the lines of the original "Dreadnought." They were launched between 1906 and 1910. They mount ten 12-inch guns in five turrets, three on the center line and one on each beam. The belt armor is 11 inches in thickness, and there is an upper belt above this of 8-inch armor. Following these, come the three dreadnoughts of the "Hercules" class, of 20,000 tons and 21.5 knots speed. They carry ten 12-inch guns and a torpedo battery of sixteen 4-inch guns, or two less than the torpedo battery of the preceding dreadnought ships, which mount for torpedo defense a battery of eighteen 4-inch guns. The turrets are disposed: three on the center line of the ship, and two amidships, placed diagonally. This arrangement gives an end-on fire at bow and stern of six 12's and a broadside of ten 12's. In respect of broadside fire these three ships are superior to the earlier dreadnoughts, above-mentioned, which suffer from the serious defect that one of the broadside turrets with its two guns is masked by the super-structure, leaving only eight guns available on each broadside. To these ships must be added the dreadnought "Osman I," built for Turkey and taken over by the British government after the declaration of war. This fine vessel, of 27,500 tons and 23 knots speed, carries the unusual battery of fourteen 12-inch guns in seven turrets, all mounted on the center line. She is protected by a 9-inch belt and 6-inch upper belt, and she carries a heavy torpedo-defense battery of twenty 6-inch guns.

In 1912 and 1913 Great Britain completed eight dreadnoughts of 23,000 tons and 22 knots speed, which are armed with ten of the new 13.5-inch guns, mounted in five turrets on the center line. The side armor was increased in extent, consisting of a 12-inch water line belt, with 9-inch and 8-inch side armor above. These ships marked a great advance upon their predecessors,



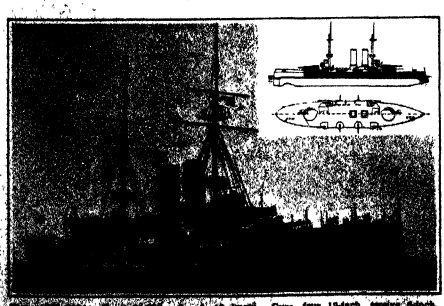
Date, 1908. Tons, 16,500. Speed, 19 knots. Guns, four 12-inch, ten 9.2-inch. Torpedo tubes, 5. Side armor, 12-inch—8-inch.

Semi-dreadnoughts: "Lord Nelson"; "Agamemnon."



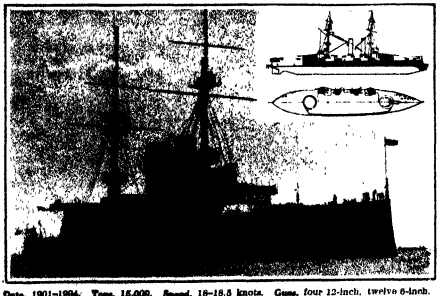
Date, 1905–1906. Tons, 16,350. Speed, 18.5–19.5 knots. Guns, four 12-inch, four 9.2-inch, ten 6-inch Torpedo tubes, 5 Side armor, 9-inch, 8-inch, 7-inch

Semi-dreadnoughts: "King Edward VII"; "Africa"; "Britannia"; "Commonwealth"; "Dominion"; "Hibernia"; "Hindustan"; "Zealandia."



Date, 1901–1904. Tons, 15,000. Speed, 18–18.5 knots. Guns, four 12-inch, twelve 6-inch. Torpedo tubes, 4 Side armor, 9-inch, 7-inch.

Pre-dreadnoughts: "Duncan"; "Albemarle"; "Exmouth"; "Russell."



Date, 1901–1904. Tons, 15,000. Speed, 18–18.5 knots. Guns, four 12-inch, twelve 6-inch. Torpedo tubes, 4 Side armor, 9-inch

Pre-dreadnoughts: "London"; "Formidable"; "Bulwark"; "Implacable"; "Irresistible"; "Prince of Wales"; "Queen"; "Venerable."

Photos by Stephen Crilly, Symonds & Co., and E. W. Hopkins.

the shell of the 13.5 gun weighing 1,400 pounds as against a weight of 850 pounds for the 12-inch gun, and the energy has gone up from 50,000 tons to 70,000 tons. In the next following ships of the "Iron Duke" class—finished in 1914—the displacement was increased to 25,000 tons. The main armament is the same, namely ten 13.5-inch guns, and the torpedo defense battery has been increased in power by substituting twelve 6-inch for sixteen 4-inch. The side armor is heavier, consisting of a 12-inch belt with 10 inches of armor from the belt to the upper deck. To these four ships must be added the dreadnought "Reshadieh," built for Turkey and taken over by the British government on the declaration of war, a ship of 23,000 tons and 21 knots speed carrying an armament of ten 13.5-inch guns and sixteen 6-inch guns.

In addition to the dreadnoughts above mentioned, there are six battle-cruisers of the "Indefatigable" type, ships of from 17,250 tons to 18,750 tons and having speeds of from 27 to 28 knots, and side armor from 8 to 7 inches in thickness. Each of these ships carries eight 12-inch guns in four turrets, one forward and one aft on the center line and one on each broadside, arranged diagonally. The latest ships of the battle-cruiser type are the "Queen Mary," the "Lion," and the "Princess Royal," of 26,350 to 27,000 tons, with a speed of from 28 to 29 knots, and side armor 9 inches in thickness. Each of these ships carries eight 13.5-inch guns in four turrets arranged on the center line.

Summing up then, the first fighting line of the British navy consists of 31 ships, 15 of which are armed with 12-inch guns and 16 with the 13.5-inch gun.

Next in fighting value to the dreadnoughts are the 10 ships of the "Lord Nelson" and "King Edward VII" classes, which ships might justly be termed semi-dreadnoughts, as coming intermediately in gun power between the pre-dreadnoughts and the dreadnoughts. The 16,500-ton "Lord Nelson" and "Agamemnon," completed in 1906, are of 19 knots speed, and carry four 12-inch and ten 9.2-inch guns all in turrets, the 12-inch being mounted in twin-gun turrets forward and aft, and the 9.2's in turrets on the broadside. The eight ships of the "King Edward" class completed in 1905 and 1906 are of 16,350 tons and 18.5 to 19.5 knots speed, and their main armament consists of four 12-inch and four 9.2-inch, with a secondary battery of ten 6-inch.

The remainder of the battleships of the British navy, 30 in number, are pre-dreadnoughts pure and simple. The latest of these, of the "Duncan" class, are of 14,000 tons, with a speed of 19 knots, and they are armed with four 12-inch and twelve 6-inch guns. They suffer from the defect that their side armor, 7 inches in thickness, is too light for ships of the battleship class. Better vessels are the 8 ships of the "London" class, completed between 1901 and 1904. They are of 15,000 tons, with a speed of from 18 to 18½ knots. They are armed with four 12- and twelve 6-inch guns, their side armor being 9 inches in thickness. The illustrations of these two classes, herewith given, will serve to give a fairly correct idea of the other ships of the first-class fighting line in the September 6, 1913.

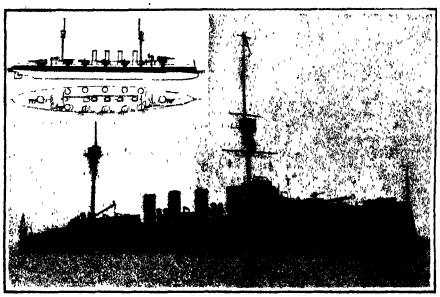
The British navy is strong in the Armored cruiser class, and we present illustrations of two of the finest types, the "Cochrane," of 13,550 tons and 23.5 knots speed, carrying six 9.2-inch and four 7.5-inch guns; and the "Minotaur" of 14,600 tons carrying four 9.2-inch and ten 7.5-inch guns. Both are protected with 6-inch belts. There are 6 ships of the "Cochrane" type and 4 of the "Minotaur." We also show a view of the "Antrim," representing a class of six armored cruisers of 10,850 tons and 22 to 23.5 knots speed, carrying four 7.5-inch and six 6-inch guns and protected by 6 inches of armor.

Great Britain possesses 74 cruisers of the unarmored type; that is vessels which carry no side armor, but depend upon the protective dock at the waterline for keeping shot and shell out of the engine rooms and magazines. To-day, the most important cruisers are those of the fast scout type, represented by the "Chatham." These are vessels of 5,400 tons, having a speed of 25.5 knots, and carrying eight 6-inch guns.

Such scouts as England possesses are not quite as fast as could be wished, and in this respect they are inferior to the German scouts of the "Breslau" type, which are good for 27 to 27½ knots. Great Britain, however, is building a large number of these of from 27 to 30 knots speed, which will become available as the war proceeds.

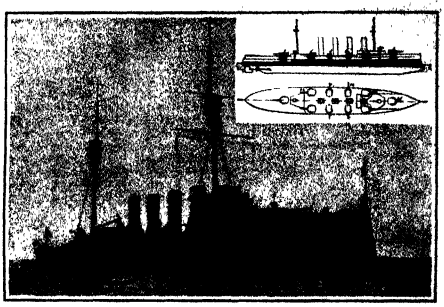
Of torpedo-boat destroyers the navy possesses 167, and of torpedo boats, 49. We illustrate the "Mohawk,"

(Concluded on page 182.)



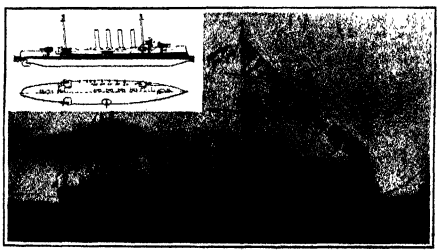
Date, 1908 Tons, 14,000 Speed, 22 5–23 knots. Guns, four 9.2-inch, ten 7.5-inch. Torpedo tubes, 5 Side armor, 6-inch.

Armored cruisers: "Minotaur"; "Defense"; "Shannon."



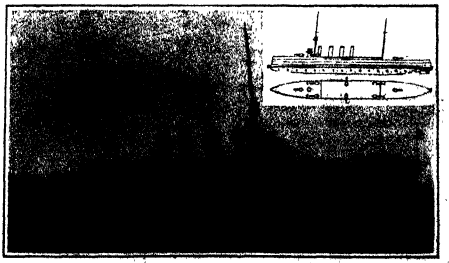
Date, 1906–1907. Tons, 13,550. Speed, 23.5 knots. Guns, six 9.2-inch, four 7.5-inch. Torpedo tubes, 3. Side armor, 6-inch.

Armored cruisers: "Cochrane"; "Achilles"; "Natal"; "Warrior"; "Duke of Edinborough";* "Black Prince."*



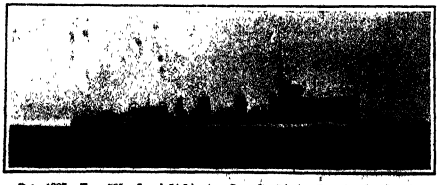
Date, 1905–1906. Tons, 10,850 Speed, 22–23 5 knots. Guns, four 7.5-inch, six 6-inch Torpedo tubes, 2. Side armor, 6-inch.

Armored cruisers: "Antrim"; "Devonshire"; "Argyll"; "Carnarvon"; "Hampshire"; "Roxburgh."



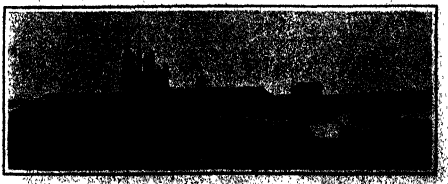
Date, 1913–1913. Tons, 5,400. Speed, 25.5 knots. Guns, eight 6-inch. Torpedo tubes, 2. Armor, 2-inch deck.

Scout cruisers: "Chatham"; "Southampton"; "Dublin"; "Nottingham"† "Birmingham";† "Lowestoft."†



Date, 1907. Tons, 865. Speed, 34.5 knots. Guns, five 3-inch. Torpedo tubes, 2.

Torpedo-boat destroyers: "Mohawk"; "Afridi"; "Cossack"; "Ghurka"; "Tartar."



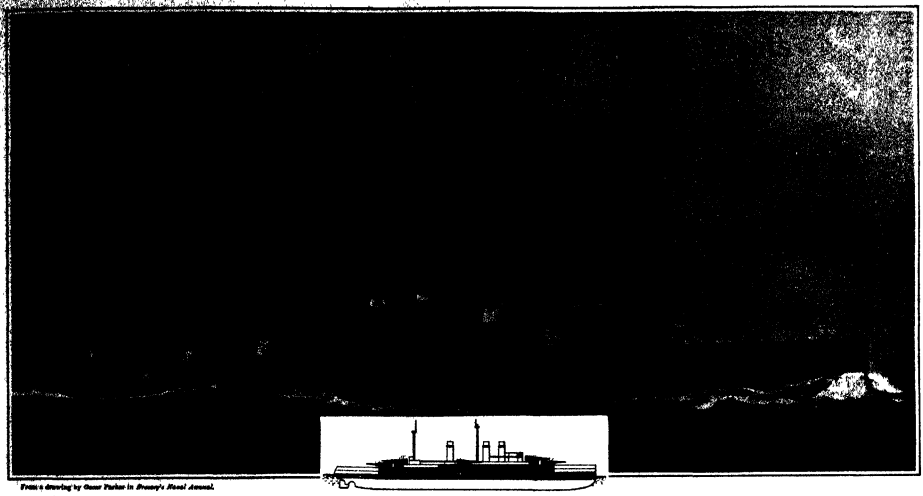
Date, 1911. Tons, 800. Speed, 25 knots. 10 submerged knots. Torpedo tubes, 5. Guns, two 4-inch. Radius, 4,000 miles.

Submarines: The "D" class of eight boats.

* These ships carry ten 6-inch in place of four 7.5-inch.

† These have also 4-inch side armor.

Photos by Stephen Cribb, Symonds & Co., and E. W. Hopkins.



From a drawing by Oscar Parkes in Brassey's Naval Annual.

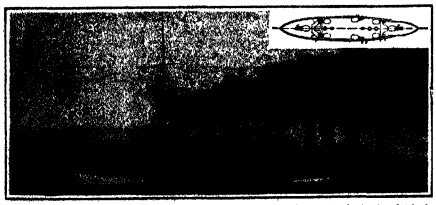
Date, 1914. Tons, 23,500 Speed, 21 knots. Guns, twelve 13.4-inch, twenty-two 5.5-inch Torpedo tubes, 4 Side armor, 11-inch—7-inch

Dreadnoughts: "Jean Bart"; "Courbet"; "France"; "Paris."

TO the French navy has fallen the duty of safeguarding the interests of the Triple Entente in the Mediterranean; and in view of the excellent quality of the small but formidable dreadnought and semi-dreadnought fleet of Austria, it is probable that the whole of the French first fighting line is concentrated in these waters. It will be the work of the French fleet to find and destroy the ships of the Austrian navy, and to assist in the reduction and capture of the Austrian naval bases. That accomplished, practically the whole of her fleet will be available to co-operate with the British fleet in the destruction of the German navy and the capture of the naval ports on the North Sea and in the Baltic.

Although France has a large programme of new construction in hand, she possesses at present only the four dreadnoughts of the "Jean Bart" class, namely, the "Jean Bart," the "Courbet," the "France," and the "Paris." These are formidable ships of 23,500 tons and 21 knots speed, carrying twelve 13.4-inch guns in six turrets. Two of the turrets are arranged on the center line forward and two aft, after the American plan, initiated on our "Michigan." The other two turrets are carried, one on each beam, and this disposition permits of the very heavy end-on fire both forward and aft of no less than eight 13.4-inch guns, and a broadside fire of ten such pieces. The main belt is 11 inches thick, and there is an upper belt of 7-inch armor. These 4 ships have been completed during the present year.

In 1911 France added to her navy 6 ships of the "Voltaire" semi-dreadnought class. These are of 18,400 tons displacement, with a speed of from 19¼ to 20½ knots. They carry four 12-inch guns in two turrets forward and aft, and the heavy broadside battery of



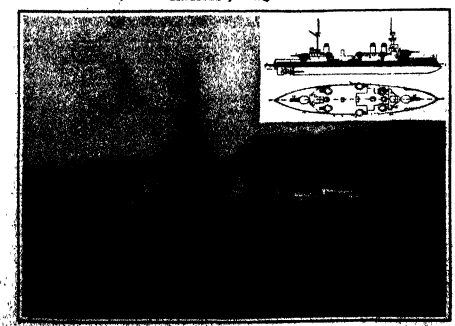
Date, 1911. Tons, 18,400. Speed, 19.5–20.5 knots. Guns, four 12-inch, twelve 9.4-inch. Torpedo tubes, 2. Side armor, 10-inch—9-inch.

Semi-dreadnoughts: "Voltaire"; "Danton"; "Condorcet"; "Diderot"; "Mirabeau"; "Vergniaud."



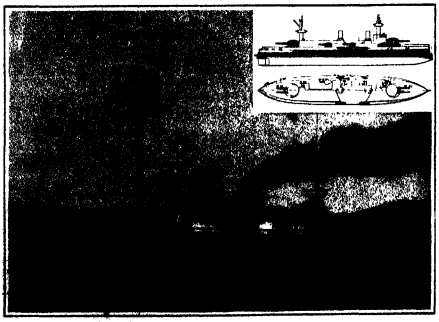
Date, 1907–1908. Tons, 14,900. Speed, 19.4 knots Guns, four 12-inch, ten 7.6-inch. Torpedo tubes, 4. Side armor, 11-inch.

Pre-dreadnoughts: "Justice"; "Democratic"; "Verite."



Date, 1906. Tons, 14,726. Speed, 19 knots. Guns, four 12-inch, eighteen 6.4-inch. Torpedo tubes, 6. Side armor, 11-inch.

Pre-dreadnoughts: "Republique"; "Patrie."



Date, 1903. Tons, 13,750. Speed, 18 knots Guns, four 12-inch, ten 6.5-inch. Torpedo tubes, 4. Side armor, 12-inch—5¾-inch.

Pre-dreadnought: "Suffren."

Photos by M. Rue, J. Rehn, and Stephen Cribb.



Date, 1910 Tons, 14,000 Speed, 23.9 knots Guns, fourteen 7.6-inch. Torpedo tubes, 2. Side armor, 6¼-inch.

Armored Cruisers: "Edgar Quinet"; "Waldeck Rousseau."

twelve 9.4-inch guns is mounted in six turrets. The side armor is 10 and 9 inches in thickness. The "Jean Barts" and "Voltaires" would be more than a match for the three Austrian dreadnoughts of the "Viribus Unitis" class and the three semi-dreadnoughts of the "Franz Ferdinand" class, which are described in the chapter on the Austrian navy. Of the remaining 12 French pre-dreadnoughts, the most important ships are those of the "Justice" and the "Republique" classes. These are of about 11,800 tons displacement and 19 knots speed. The "Justice" carries four 12-inch guns forward and aft, and ten 7.6-inch guns on the broadside, six of them in single gun turrets and four in casemates. The "Republique" and "Patrie" are armed with four 12-inch guns and eighteen 6.4-inch, the latter being mounted on the broadside in six armored turrets. These five ships have water line protection of 11 inches of armor.

The earlier pre-dreadnoughts, such as the "Suffren," "Boudet," and "Jaureguiberry" carry a main armament of two 12 inch and two 10.8-inch guns, with broadside secondary batteries and 5.5 and 6.5-inch pieces.

Unquestionably the most picturesque feature of the French navy is the armored cruisers, some of which, like the "Edgar Quinet," have no less than six smokestacks, which, though they may be attractive to the public eye, would present an equally attractive target to the enemy. The "Edgar Quinet" and "Waldeck Rousseau" are the finest of the 20 ships of the armored-cruiser class. They are of 14,000 tons, and about 24 knots speed, and are protected by 6¾ inches of belt armor. In these, as in all the French armored cruisers, the battery is rather light, the 7.6-inch gun being the heaviest piece carried. Except in this particular, however the French armored cruisers are very serviceable ships, well protected and showing a good turn of speed. They are doing excellent service in the present war, in running down the German and Austrian cruisers, and in capturing and driving into neutral ports the merchant ships of the enemy.

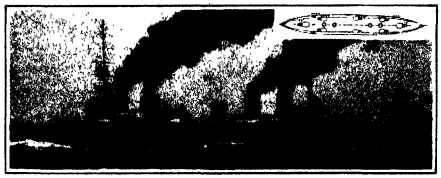
In the protected-cruiser class, the French navy is rather weak, possessing only 9 ships of this type.

When we come to the torpedo-boat destroyer and submarine service, however, we find that the French navy is remarkably well equipped, possessing 84 destroyers and no less than 135 torpedo boats. On the average, the French destroyers are smaller than those of the other nations; although of late years the French have been building in larger sizes and have turned out for their navy some of the fastest vessels of this class afloat.

The submarine fleet of the French navy is very large, consisting of 64 boats, and we believe that this service is highly efficient. When the Austrian navy shall have been disposed of, the destroyer and submarine fleets of the French will no doubt play a very important part in the campaign for the capture or destruction of the German fleet in the Baltic.

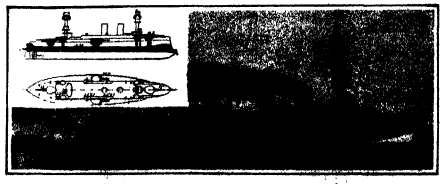
A Novel Electromechanical Movement

At the recent Conversazione of the Royal Society, Mr. W. M. Mordey exhibited an electrically driven pendulum or balance wheel without any make-and-break, commutator, or equivalent device. A simple one-phase alternate-current induction motor with a rotor having a short-circuited winding, in the field of a stator excited by alternate-current, develops a torque which is always in the direction of motion. If provided with a pendulum, or with a spring in the manner of a balance wheel, the rotor, if set in motion, will continue to oscillate, friction and other losses, or any load put on it, being made up by energy taken from the circuit.



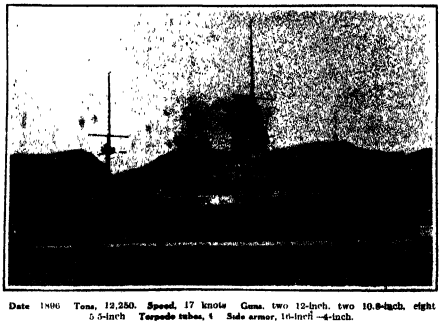
Date, 1906 Tons, 12,400. Speed, 23 knots. Guns, four 7.6-inch, sixteen 6.4-inch. Torpedo tubes, 5. Side armor, 6¾-inch.

Armored cruisers: "Victor Hugo"; "Leon Gambetta"; "Jules Ferry."



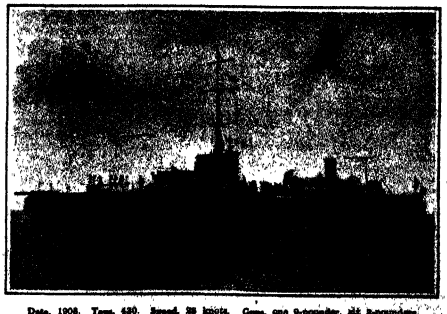
Date, 1893. Tons, 11,800. Speed, 17.6 knots. Guns, two 12-inch, two 10.8-inch, eight 5.5-inch. Torpedo tubes, 2. Side armor, 17¾-inch—9¾-inch.

Pre-dreadnought: "Jaureguiberry."



Date 1896 Tons, 12,250. Speed, 17 knots Guns, two 12-inch, two 10.8-inch, eight 5.5-inch Torpedo tubes, 4 Side armor, 16-inch—4-inch.

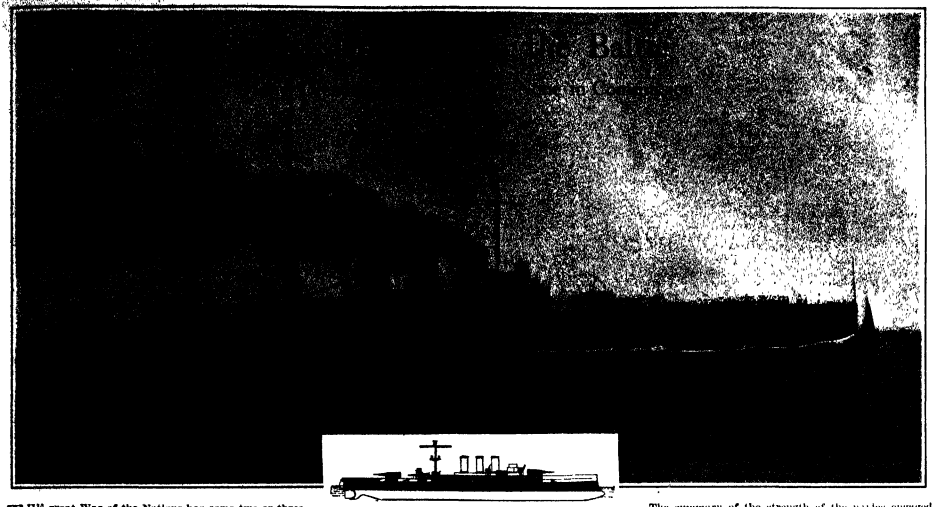
Pre-dreadnought: "Bouvet."



Date, 1908. Tons, 430. Speed, 28 knots. Guns, one 9-pounder, six 3-pounders. Torpedo tubes, 3.

Torpedo-boat destroyer: "Fanion."

Photos by W. Rau, J. Kuhn and Stephen Crilch.



THE great War of the Nations has come two or three years too soon for the Russian Navy, which, so far as its first fighting line is concerned, is still in the making. The Japanese War practically wiped out the capital ships of the Russian fleet, and it was only in 1909 that she set about the recreation of her navy upon modern lines. In that year she laid down four dreadnoughts, of 23,300 tons, which are to steam 23 knots, and will mount a battery of twelve 12-inch guns in four three-gun turrets. In 1912 she laid down four huge armored cruisers of 32,000 tons and 27 knots speed, which are to carry a battery of twelve 14-inch guns.

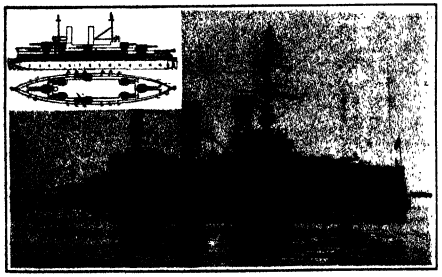
Date, 1907. Tons, 16,000. Speed, 21.5 knots. Guns, four 10-inch, eight 8-inch, twenty 4 7-inch. Torpedo tubes, two. Side Armor, 6 inch—3-inch.

Armored cruiser: "Rurik."

Unless the war should be long drawn out, these ships are unlikely to see any active service. Three dreadnoughts, of 22,500 tons, carrying ten 12-inch guns, are being built in the Black Sea.

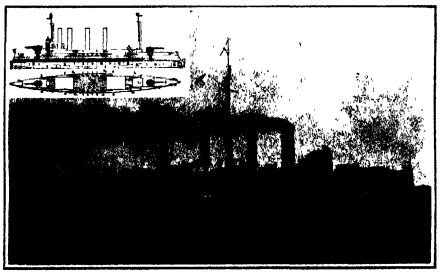
The summary of the strength of the navies engaged in the war, given on page 174 of this issue, credits Russia with no dreadnoughts, 7 pre-dreadnoughts, 2 coast defense vessels, no battle-cruisers, 6 armored cruisers, 9 protected cruisers, 91 destroyers, 14 torpedo boats, and 30 submarines; but it should be remembered that this enumeration includes the Black Sea fleet, whose operations are limited by treaty to those waters, and the vessels of the Asiatic squadron. The present article is concerned with the Baltic fleet, whose ships alone are available for operations in the present war.

(Concluded on page 198.)



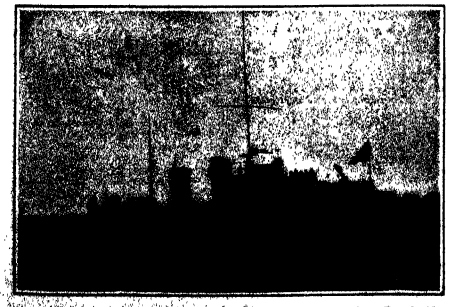
Date, 1906. Tons, 13,500. Speed, 18 knots. Guns, four 12-inch, twelve 6-inch. Torpedo tubes, 4. Side armor, 7½ inch.

Pre-dreadnoughts: "Slava"; "Tsarevitch."



Date, 1907. Tons, 7,700. Speed, 22.5 knots. Guns, two 8-inch, eight 6-inch. Torpedo tubes, 2. Side armor, 7-inch—3¼ inch.

Armored cruisers: "Admiral Makaroff"; "Pallada"; "Bayan."



Date, 1904. Tons, 425. Speed, 26 knots. Guns, two 3-inch, six 6-pounders. Torpedo tubes, 3.

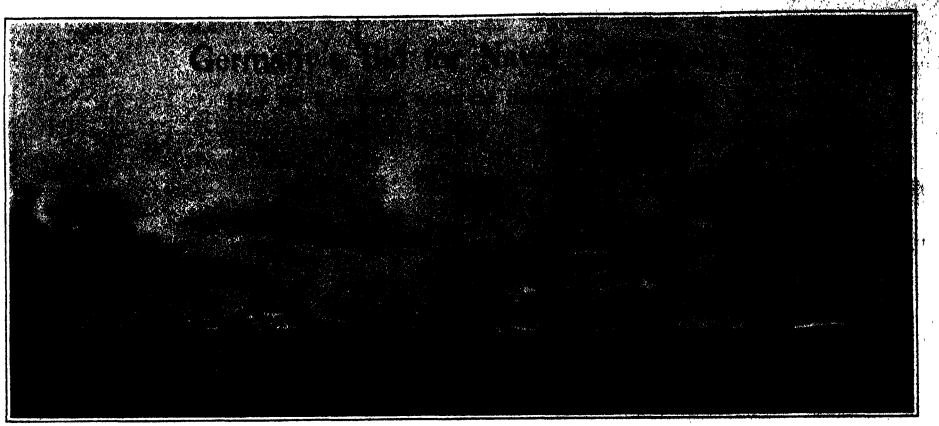
Torpedo-boat destroyers: "Bezshumnie"; "Okhotnik"; "Pogranitschnik"; "Sibirskij-Strelok."



Date, 1902-04. Tons, 6,675. Speed, 23.24 knots. Guns, twelve 6-inch, twelve 3-inch. Torpedo tubes, 4. Armor, 3-inch deck.

Protected cruisers: "Oleg"; "Bogatyr."

Photos by Symonds & Co.

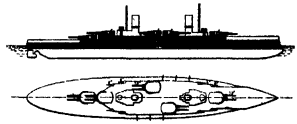


A division of German dreadnoughts, "Westphalen" in the van.

As we have shown elsewhere in the present issue, any estimate of the strength of the German fleet, whether for offense or defense, must take into consideration the enormous strategic advantage to Germany of the Kiel Canal. It is a well-accepted principle of naval strategy, that a fleet should never be divided except in cases of urgent necessity; and it is the working of this principle in connection with this famous waterway which runs from Kiel in the Baltic to the mouth of the Elbe on the North Sea, which goes far to offset the numerical superiority of the British fleet, which at the present writing holds the Germans on the defensive in the Baltic.

In the absence of any reports to the contrary, it is reasonable to suppose that the dreadnought and pre-dreadnought fleets constituting Germany's first and second fighting line are gathered in the Baltic under the command of Admiral von Tirpitz. Also, it is probable that the four British battle-cruisers of the "Inflexible" type, which were in the Mediterranean at the opening of the war, have been withdrawn to the North Sea—this for the reason that the French fleet has a sufficient preponderance of strength to contain the Austrian fleet in the Adriatic. If the "Inflexibles" are in the North Sea, the first fighting line of the German navy, consisting of 16 dreadnoughts (the "Goeben" having been driven into the Dardanelles) finds itself opposed by a British first fighting line of 31 dreadnoughts, an inferiority of one to two. In the second fighting line, consisting of pre-dreadnoughts, Germany can oppose 20 ships to Great Britain's 40.

Now it is evident that for the Germans to come out and give battle in the North Sea, even if we allow for the chances of war, would be suicide; for although in a general engagement she could do terrible damage to the British fleet, the result could have no bearing upon the issues of war, and such damage as was done would be at the cost of the wiping out of the German navy.



Date, 1912. Tons, 24,800. Speed, 21.5 knots. Guns, ten 12-inch, fourteen 6-inch. Torpedo tubes, 5. Side armor, 14-inch—7-inch.

Dreadnoughts: "Kaiser"; "Friederich der Grosse"; "Kaiserin"; "Prinz Regent Luitpold"; "Konig Albert."

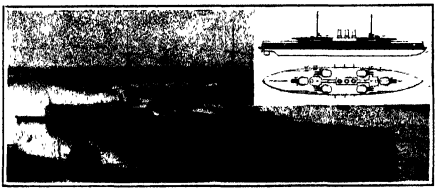
On the other hand, so long as Germany holds the Baltic, with a means of quick passage to the North Sea by the Kiel Canal, she can never be attacked by the whole of the British fleet; for if Sir John Jellicoe decided to force the Danish straits and seek out and engage the German fleet, he would have to leave at least half of his first fighting line at the mouth of the Elbe, or else expose the blockading fleet at that point to the risk of being encountered by the Germans in superior force.

Meanwhile, Germany, having the control of the Baltic, can prevent any landing of an expeditionary force upon her northern borders, and she is in a position, moreover, to accomplish the destruction of the Russian fleet and the bombardment of her ports and harbors.

The pride of the German navy is her fleet of dreadnoughts, and if this were lost, the remnants of her battleship fleet, because of the comparatively low power of the guns of its main armament, would be unable to give battle with much hope of success, even against a pre-dreadnought line of the same date of construction.

The original British dreadnought was built in 1905, and in 1906-07, Germany laid down her first four dreadnoughts of the "Nassau" class, of 18,600 tons and 20.5 knots, protected by 11½-inch side armor and carrying a battery of twelve 11-inch and twelve 6-inch guns. In the arming of these ships, the Germans made two very serious mistakes. First, they mounted an 11-inch gun when the other powers were mounting the 12-inch, and secondly, they placed two of the turrets on each beam, with the result that in a broadside engagement four of the 11-inch guns are out of action, being masked by the opposite turrets on the engaged side.

In the four ships of the "Thuringen" class, completed in 1911-12, the mistake made in the "Nassau" class was partly rectified. The comparatively weak 45-caliber 11-inch piece gave way to a 50-caliber 12-inch piece of vastly greater power and efficiency, especially at long ranges. The displacement of these ships is 22,000 tons, and the speed 21.5 knots. They are protected by 11½ inches of side armor.



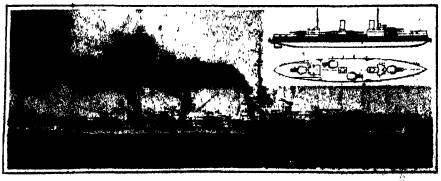
Date, 1911-12. Tons, 22,000. Speed, 21.5 knots. Guns, twelve 12-inch, fourteen 6-inch. Torpedo tubes, 6. Side armor, 11½-inch—6¼-inch.

Dreadnoughts: "Thuringen"; "Helgoland"; "Ostfriesland"; "Oldenberg."



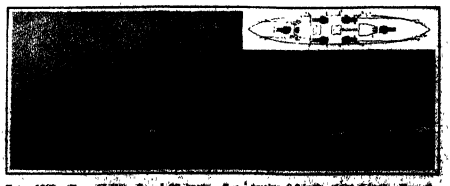
Date, 1909-10. Tons, 18,600. Speed, 20.5 knots. Guns, twelve 11-inch, twelve 6-inch. Torpedo tubes, 6. Side armor, 11½-inch—7-inch.

Dreadnoughts: "Westfalen"; "Nassau"; "Posen"; "Rheinland."



Date, 1911. Tons, 18,700. Speed, 27.5 knots. Guns, eight 11-inch, ten 6-inch. Torpedo tubes, 4. Side armor, 10-inch—4½-inch.

Battle-cruiser: "Von der Tann."

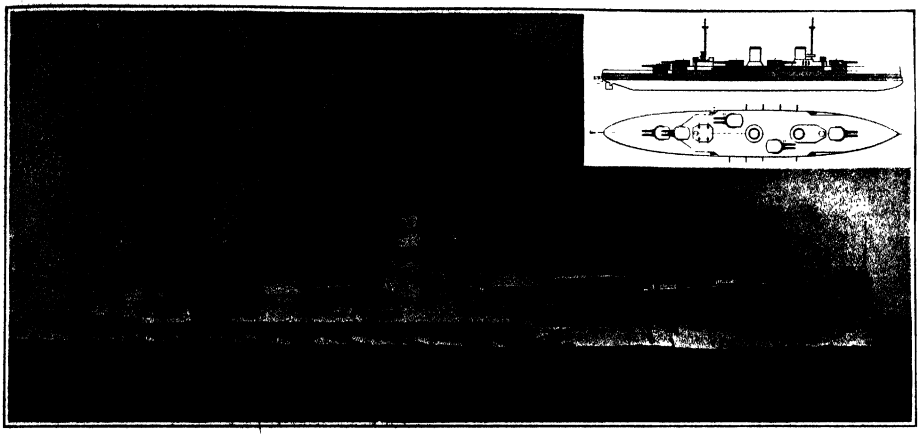


Date, 1909. Tons, 15,700. Speed, 20 knots. Guns, twelve 8.2-inch, eight 6-inch. Torpedo tubes, 6. Side armor, 6-inch.

Armored cruiser: "Blucher."

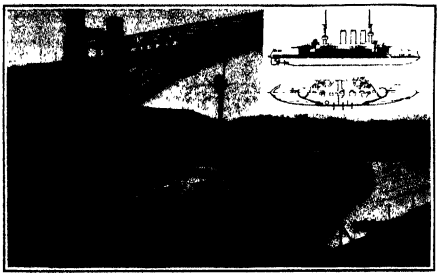
Photos by A. Renard.

For reasons best known to themselves, the German ordnance officers, or whoever is responsible for the disposition of the armament, deliberately sacrificed a third of the effectiveness of the broadside of the "Thuringen" class, by retaining the quadrilateral arrangement of turrets that exists in the "Nassau" class. The Germans are great theorists; but in this case the theory of the value of a head-on attack, in which the ship can concentrate a fire of six guns, led them in the wrong direction. There is a consensus of opinion among naval men that no wise admiral will expose his ships to the danger of being raked in the end-on position by the 12- and 14-inch guns of the enemy. Future battleship engagements will be fought broadside to broadside, at ranges of from 9,000 to 11,000 yards



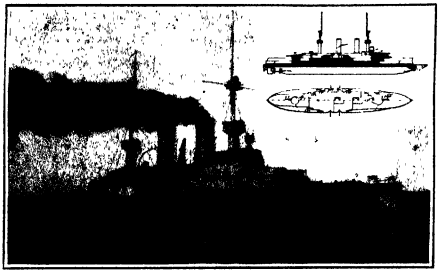
Data, 1911-13, Tons, 23,000-25,000. Speed, 28 knots Guns, ten 11-inch, twelve 6-inch Torpedo tubes, 4 Side Armor, 11-inch—4-inch.

Battle-cruisers: "Moltke"; "Seydlitz." ("Goeben," driven to the Dardanelles; sold to Turkey.)



Data, 1904-08. Tons, 13,000. Speed, 20 knots. Guns, four 11-inch, fourteen 6.7-inch. Torpedo tubes, 6. Side armor, 9-inch—6-inch

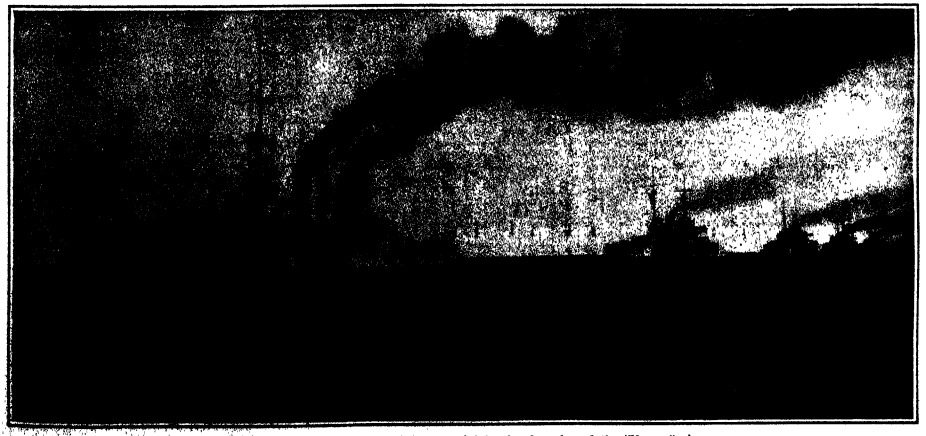
Pre-dreadnoughts: "Braunschweig"; "Elsass"; "Lothringen"; "Hessen"; "Preussen"; "Deutschland"; "Hannover"; "Pommern"; "Schleswig-Holstein"; "Schlesien." (This view shows "Lothringen" in the Kiel Canal.)



Data, 1902 03 Tons, 11,800. Speed, 18-19 knots. Guns, four 9 4-inch, eighteen 6-inch Torpedo tubes, 6 Side armor, 9-inch.

Pre-dreadnoughts: "Mecklenburg"; "Wittelsbach"; "Schwaben"; "Wettin"; "Zahringen."

Photos by A. Renard



Pre-dreadnought "Hannover" (left) preceded by dreadnoughts of the "Nassau" class.

In the five ships of the "Kaiser" class, completed in 1912-13, the Germans rectified their mistake by placing three of the turrets on the center line and the other two diagonally on the broadside, thereby enabling the whole of the battery to train on either beam. This is a better, but not the best, arrangement since the midship turrets mask each other throughout a considerable arc of fire.

In their four ships of the "Grosser Kurfurst" type, which are due for completion toward the close of the present year, the Germans have followed the principle (inaugurated by the naval constructors of our own navy) of placing all the turrets on the center line of the ships. The "Kaiser" class are of 24,700 tons displacement and 21.5 knots speed. They are heavily protected with side armor ranging from 14 to 7 inches in thickness. They mount ten 12-inch 50-caliber guns, and fourteen 6-inch.

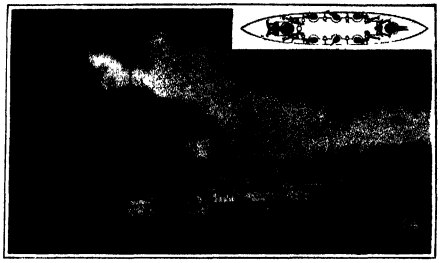
Germany possesses four battle-cruisers of great speed and power, which have the enormous advantage over the armored cruisers of other navies that the side armor is of battleship thickness. This means that they can be placed in the first fighting line, and take the blow of the heaviest projectiles of the enemy, with the expectation of no greater chance of disablement than the battleship. In this the Germans have shown great forethought, and it must be admitted that this superiority in protection largely offsets the fact that their main armament of 11-inch guns is much weaker than the armament of 12's and 13.5's mounted on the battle-cruisers of the British navy.

The "Von der Tann," completed in 1910, of 18,700 tons displacement and 28 knots speed, has 10 inches of side armor, and mounts eight 11-inch 45-caliber guns in turrets. The "Moltke," completed in 1911, of 23,000 tons and 28 knots speed, is protected with 11 inches of side armor, and carries ten 50-caliber 11-inch guns in turrets. The "Seydlitz," of 25,000 tons, has made 29 knots. She has the same protection and armament as the "Moltke." All of these ships carry powerful torpedo defense batteries of 6-inch guns.

The pre-dreadnoughts of the German navy, 20 in number, were built in classes of 5 each, and all of them suffer from the defect of carrying too light a gun in their main batteries. Thus the 10 ships of the "Kaiser Wilhelm II" and "Wittelsbach" classes carry as their main battery four 9.4-inch 40-caliber guns—a piece which would be wofully ineffective at the great ranges at which modern engagements will be fought. In the "Braunschweig" class of 5 ships the main battery consists of four 11-inch guns of 40 calibers, and the same thing is true of the 8 ships of the "Deutschland" class. The remaining energies, even of these 11-inch guns, at a range of 10,000 yards would not be sufficient to effect the penetration of battleship armor.

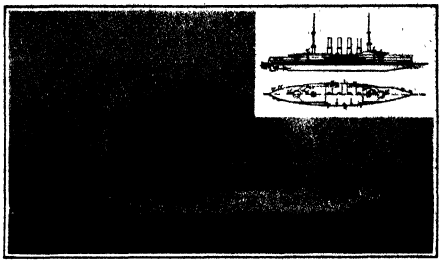
The nine armored cruisers of the German fleet are headed by the "Blucher," a fine ship of 15,900 tons, protected by 6-inch armor and mounting twelve 8.2-inch 45-caliber guns in turrets and a broadside of eight 6-inch guns. Her speed is 26 knots. The "Scharnhorst" and "Gneisenau," completed in 1907, are of 11,800 tons and 23 to 24 knots speed. They are protected by 8 inches of armor and carry eight 8.2-inch 40-caliber guns and six 6-inch. The "Roon" and "Yorck," completed in 1905-1906, are 9,050 tons displacement, are protected by a 4-inch belt, and carry four 8.2-inch 40-caliber guns in turrets and ten 6-inch 40-caliber guns on the broad-

(Concluded on page 199.)



Date, 1898-1901 Tons, 10,800. Speed, 18 knots Guns, four 9.4 inch, eighteen 6-inch. Torpedo tubes, 6 Side armor, 9-inch—6-inch.

Pre-dreadnoughts: "Kaiser Wilhelm II"; "Kaiser Friederich III"; "Kaiser Barbarossa"; "Kaiser Wilhelm der Grosse"; "Kaiser Karl der Grosse."



Date, 1908. Tons, 11,500. Speed, 22.5-23.5 knots. Guns, eight 8.2-inch six 6-inch. Torpedo tubes, 6. Side armor, 6-inch—5-inch.

Armored cruisers: "Scharnhorst"; "Gneisenau."



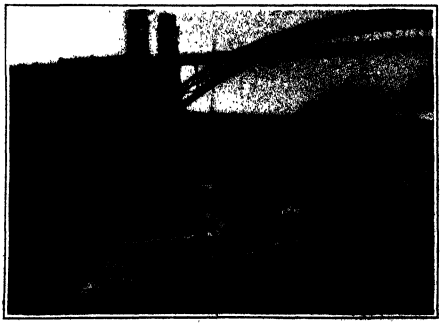
Date, 1908 Tons, 3,450. Speed, 23 7-24 knots. Guns, ten 4.1 inch. Torpedo tubes. 2. Armored deck, 2-inch.

Protected cruisers: "Stettin"; "Stuttgart"; "Nurnberg."



Date, 1909-10. Tons, 4,350. Speed, 27 knots. Guns, twelve 4.1-inch. Torpedo tubes, 2. Armored deck, 2-inch.

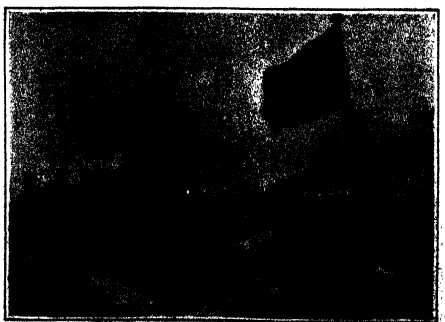
Scout cruisers: "Augsburg"; "Kolberg"; "Mainz"; "Köln." Also "Breslau" class, 27.5 knots, and "Karlsruhe" class, 28 knots.



Date, 1903. Tons, 2,715. Speed, 21.5 knots. Guns, ten 4.1 inch. Torpedo tubes, 2. Armored deck, 2-inch.

Protected cruisers: "Arcona"† "Frauenlob"; "Undine."

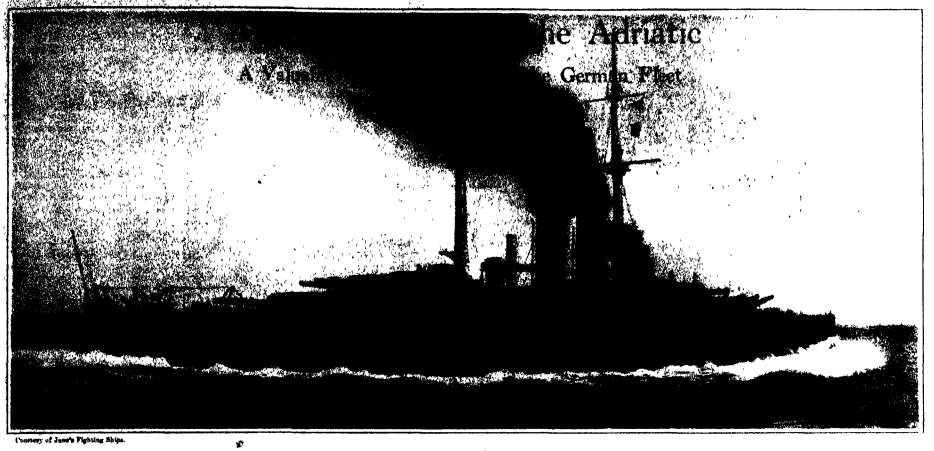
† "The "Arcona" is here seen passing through the famous Kiel Canal.



Date, 1909. Tons, 620. Speed, 33.5 knots. Guns, five 3.4-inch. Torpedo tubes, 2.

Group of destroyers maneuvering at full speed.

Photos by A. Benoit.

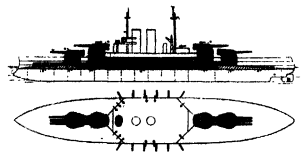


Courtesy of Jane's Fighting Ships.

ALTHOUGH the strategical situation of the present war, as affected by the geography of the countries concerned, is standing Germany in good stead, as we have shown in a previous chapter, it also hits her very hard in cutting off entirely from any close co-operation the efficient little fleet of Austria in the Adriatic. Immediately upon the declaration of war, the French fleet closed in on the Adriatic; and the probability is that at the present time the Austrian fleet is at the northern end of that gulf, closely blockaded by a French fleet of greatly superior power. If the Austrian fleet has retreated to Port Pola, it is secure in a land-locked harbor, on either side of the entrance of which are heavy modern coast defenses. Pola is a dock-yard with two fixed drydocks and a floating dock; and judging from the frequency with which this place has been mentioned in the war dispatches, it is not unlikely that the Austrian fleet is gathered there.

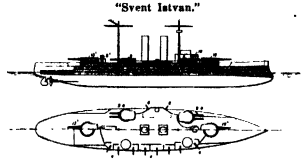
The most valuable asset of the Austrian fleet is the pre-dreadnoughts of the "Viribus Unitis" class, and the three semi-dreadnoughts of the "Franz Ferdinand" class, all six vessels being of thoroughly modern construction, heavily armed and well-protected.

The "Viribus Unitis" was one of the first dreadnoughts to adopt the three-gun turret. It is significant of the great capacity for gun-mounting afforded by this triple arrangement, that, on the modest displacement of 20,000 tons, the "Viribus Unitis" and her sisters mount no less than twelve 12-inch guns apiece. The four turrets are disposed on what has come to be known as the "Michigan" plan; there being two turrets forward, the guns of the after turret firing above the roof of the fore turret, and two turrets aft having a similar arrangement for gun fire. The advantage of this arrangement is that every gun can be trained through a wide arc of broadside fire, and that there is a possible concentration of guns, dead ahead or dead astern of six 12-inch pieces. The ships, despite their heavy battery, are well protected, carrying side armor of 11-inch thickness at the water-line, above which, between turrets 2 and 3, is side armor of 8 inches thick-



Date, 1913-14. Tons, 20,000. Speed, 20.7 knots. Guns: twelve 12 inch, twelve 6-inch. Torpedo tubes, 4. Side armor, 11-inch—8-inch—6-inch.

Dreadnoughts: "Viribus Unitis"; "Tegetthoff"; "Svent Istvan."



Date, 1910-11. Tons, 14,800. Speed, 20.5 knots. Guns: four 12-inch, eight 9.4 inch, twenty 4-inch. Torpedo tubes, 3. Side armor, 9 inch.

Semi-dreadnoughts: "Erzherzog Franz Ferdinand"; "Radetzky"; "Zrinyi."

ness, while above this, covering the 6-inch battery, is 6 inches of armor. The speed is 20.7 knots, and each ship carries four torpedo tubes.

Austria possesses three semi-dreadnoughts of 14,500 tons, 20.5 knots speed, protected by side armor whose thickness from the water-line up is, respectively, 9 inches, 6 inches, and 3 inches; and each of them carries three torpedo tubes. The battery is heavy, consisting of four 12-inch, and eight 9.4-inch guns all mounted in turrets. For torpedo defense, each ship carries twenty 4 inch 50-caliber guns.

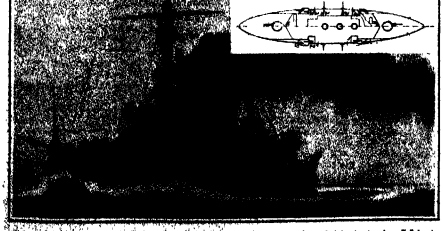
Of pre-dreadnoughts of battleship size, Austria possesses three of the "Ferdinand Max" type. These would have been more effective ships if the Austrians, influenced no doubt by German practice, had not mounted the 9.4-inch 40-caliber gun as their main armament. Of these the "Ferdinand Max" and class carry each four in two turrets, and there is a heavy broadside battery of twelve 7.6 inch guns. These vessels are of 10,500 tons and 20.5 knots speed. The side armor is from 8¼ to 6 inches.

Important vessels for coast defense are the six ships of the "Hapsburg" and "Wien" classes, the "Hapsburg" of 8,340 tons and 19.5 knots speed, mounts three 9.4-inch guns in turrets and twelve 6's in casemates. The armor is 8⅞ inches. The "Hapsburg" class was completed in 1903-04. The "Wien" class carry four 9.4-inch and a battery of six 6-inch on a displacement of 5,000 tons. They were built in 1895 to 1896, and are protected by a 10½ inch belt of armor.

Austria possesses two modern armored cruisers: "Sankt George," 7,400 tons, 22 knots, mounting two 9.4's and five 7.6's; and "Kaiser Karl VI," 6,300 tons and 20 knots, carrying two 9.4's and eight 6's. Smaller and older vessels are the "Kaiserin Theresia" and the "Kaiserin Elizabeth," of 5,200 and 4,000 tons displacement, and 17½ and 19 knots speed, respectively. The "Theresia" carries two 7.6-inch and eight 6-inch guns and the "Elizabeth" six 6-inch guns.

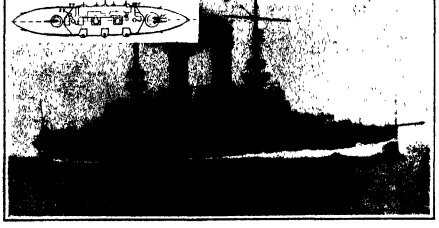
Of the protective cruisers the most valuable are the four fast scouts, "Saida," "Helgoland," Novara," and "Admiral Spaun." They are of 3,500 tons and 27 knots speed, and mount a battery of 4 1-inch guns.

Next to her dreadnoughts and semi-dreadnoughts, the most valuable vessels of the Austrian fleet are her 18 destroyers, 39 torpedo boats, and 6 submarines. The destroyers are from 400 to 800 tons and from 28 to 32 knots speed, and the torpedo boats run in displacement from 110 to 250 tons and in speed from 26 to 28 knots.



Date, 1906-09. Tons, 10,600. Speed, 20.6½ knots. Guns, four 9.4-inch, twelve 7.5-inch. Torpedo tubes, 5. Side armor, 9¼-inch.

Pre-dreadnoughts: "Erzherzog Ferdinand Max"; "Erzherzog Karl"; "Erzherzog Friedrich."



Date, 1903-04. Tons, 8,340. Speed, 19.5 knots. Guns, three 9.4 inch, twelve 6-inch. Torpedo tubes, 2. Side armor, 8⅞-inch—6 inch.

Pre-dreadnoughts: "Hapsburg"; "Arpad"; "Babenberg."

Photos by F. W. Schirmer.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of Interest to Farmers.

POTATO SORTER.—E HELLBACH, Wallhalla, N D. This improvement refers to machines for sorting and grading fruits and vegetables, and the main object thereof is to provide such a machine which automatically performs such operation without injury to the articles being graded, and which delivers the same at different points, according to grade.

Of General Interest.

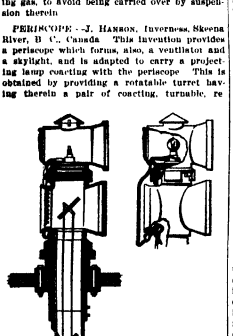
PROCESS FOR PRODUCING MOLDS FOR CASTING STEREOTYPE PLATES.—C WIRZ LER, Berne, Switzerland Hot gases, hot air, or a hot liquid may be introduced into hollow chambers provided in the mold during the turning operation in this invention If the mold has no special hollow chambers a heating device may be employed, which can have any suitable construction, and may consist, for example, of pipes containing some hot agent and brought into contact with the mold.

CIGARETTE BOX.—A. MENDELSON and B. J. GOLDBERG, 482 Marcy Ave., Brooklyn, N. Y. In this instance the invention has reference to improvements in cigarette boxes or boxes for dispensing cigarettes or similar articles, in which it is essential that such articles be spaced apart to be readily grasped and withdrawn with convenience and without being mutilated

SANITARY DENTAL IMPRESSION TRAY.—G. L. ORER, assignor to The L. D. Caulk Co., Milford, Del. This invention provides a device having a body portion and a handle therefor with novel means for detachably securing the body portion to the handle He also provides a dental tray handle capable of being secured to trays of different sizes without necessitating any adjustment of the handle itself.

VAPOR CONDENSER.—G M HILGER, 1540 W 62nd St., Chicago, Ill This invention provides a condenser constructed and arranged to cause the liquid vapor to travel in a current or direction counter to the flow of a cooling liquid, provides means for separating the condensed vapors from contained gases, and provides means whereby the products of condensation are conveyed out of the path of the flowing gas, to avoid being carried over by suspension therein

PERISCOPE.—J. HARRON, Inverness, Skeena River, B. C., Canada This invention provides a periscope which forms, also, a ventilator and a skylight, and is adapted to carry a projecting lamp coacting with the periscope This is obtained by providing a rotatable turret having therein a pair of coacting, turnable, re



PERISCOPE.

flecting mirrors forming the periscope, said turret forming a ventilator, and also having a lens at the top thereof, forming the skylight, and a projecting lamp adapted to engage the turret above said lamps and coacting with the mirrors

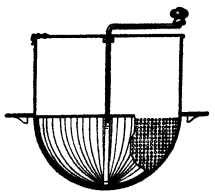
ANTI-RATTLER AND SASH ADJUSTER FOR WINDOWS.—H. W ILLENBERG, care of A. D. Dwright, 2nd Chevrolet St., New Orleans, La. The purpose here is to provide a device which will also possess the capabilities of operating to hold a sash in an adjusted position when raised or lowered, in addition to preventing the sashes from rattling and causing the same to fit tightly in the guideways of the frame, in such a manner as to exclude draft and wind and the effects of inclement weather

Heating and Lighting.

OIL BURNER.—A. D. MARCOTTE, care of Eunice Carriage and Machine Shop, Eunice, La. In the present invention the object is the provision of an improved device for burning crude or low-grade oil, so as to effect its complete combustion without production of soot or smoke, which are frequently incident to the burning of oils of this character.

Household Utilities.

COLANDER.—SARAH E. DE CERVOCOSUR, 277 W. I St., Colton, Cal. This invention relates to culinary utensils, and particularly to what are known as colanders, and the object is to provide a structure which is designed to move



IMPROVED COLANDER.

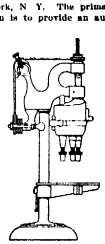
fruit or other material transversely of a perforated straining member through which it is gradually forced, so as to more easily and uniformly distribute the straining.

Machines and Mechanical Devices.

GRAVEL MACHINE.—H T. SYKES, New London, Mo This machine removes sand or gravel from a pit or holder and deposits it on board cars or other receptacles, and is so arranged that the device will load and unload itself, and wherein a dumping door is provided, so arranged that it will automatically open when the machine reaches the dumping position, and automatically close as the machine returns to loading position

VALVE.—N R CREIGHTON, Chicago St., Elmhurst, L. I., N Y This invention provides a valve for use in pipe lines conveying gas liquids, or other fluids from place to place, and arranged to normally hold the valve in open position for passage of the fluid and to allow of releasing the valve from a distant point whenever it is desired to close the valve, and to permit the valve to close automatically in case of fire and to hold it locked in closed position

AUTOMATIC MULTIPLE-CHUCK DRILL PRESS.—JOSEPH N LANDAU, 101 West 117th St., New York, N Y. The primary object of the invention is to provide an automatic mul-

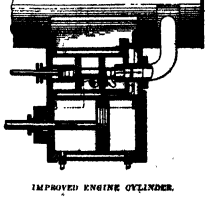


AUTOMATIC MULTIPLE-CHUCK DRILL-PRESS.

tiple-chuck drill-press in which either of the chucks or tool holding devices may be brought into successive coupling position to be rotated or operated from a single working spindle, the improvement being designed to be applied to machines which are now generally constructed, or to a machine having a specially mounted and driven spindle.

Prime Movers and Their Accessories.

ENGINE CYLINDER.—A W GUSTAFSON, 115 Harrison Ave., Jersey City, N J The objects in this case are, to prevent loss of heat in the expansive medium employed by the engine, to automatically create and maintain a

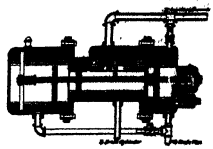


IMPROVED ENGINE CYLINDER.

jacket of rarefied air surrounding the chambers containing the expansive medium; and to simplify the construction whereby these objects are obtained.

Railways and Their Accessories.

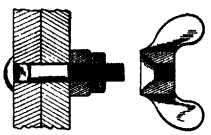
TRIPLE VALVE.—E. G. MARCUS, Box 270, Clovis, New Mex. This invention relates to fluid pressure brakes of the Westinghouse or similar types, and its object is to provide a valve arranged to utilize an equalizing pres-



TRIPLE VALVE FOR AIR BRAKES.

sure and the combined force of the train line and brake cylinder pressure for properly controlling the triple valve and preventing uneven pressures in the brake cylinder and to prevent undesired quick action application.

NUT LOCK.—J. G. SCHNEIDER, York, Pa. This nut lock is particularly adapted for use in securing fish plates to railway rails, but, of course, is capable of general application.



IMPROVED NUT LOCK.

The jam of locking nut has a body formed of a soft elastic material such as cork, and an inclosing casing of thin sheet metal, both of which are compressed into conical form engaging the thread of the bolt to which the main nut is applied.

Pertaining to Vehicles.

BICYCLE CRANK HANGER.—G. W. MCILWAINE, 114 Feronia Way, Rutherford, N J. This invention provides a hanger adapted especially for repair work, although it may be used in connection with new devices. The hanger is well adapted to be applied to various sizes or makes of bicycle brackets without reconstruction except to cut off certain of the parts, according to the required length.

TRACTION ENGINE.—S. S. MORTON, care of the Herr Engine Co., Portsmouth, Ohio. The object of the invention is to so construct the tractor that the power will be distributed evenly to the driving wheels and that simplicity of operation will be obtained with a construction that is strong, yet flexible, as regards accommodating itself to inequalities of the ground.

Designs.

DESIGN FOR A POT AND COVER LIFTER.—K. PROCHASKA, Vienna, Austria-Hungary, care of Berthold Lehner, 25 W. Broadway, New York, N. Y. Views of this design, showing it in perspective, plan, and edge positions, present an article indicating strength, utility, and ornamental lines.

DESIGN FOR A FRUIT AND VEGETABLE KNIFE.—H BOSWORTH, care of W. G. Bosworth, 110 Broadway, New York, N. Y. This ornamental design for a knife in side view shows a flat, thin blade, one third of its length considerably narrowed in its height, and the edge view showing a straight blade turned up at its end. The handle is of graceful form.

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Inquiry No. 9279. Wanted manufacturers' information desired concerning available specimens.

Inquiry No. 9280. Wanted the name and address of a manufacturer of burners to be used for gas-heated sad iron.

Inquiry No. 9281. Wanted the name and address of manufacturers of vacuum adhesive hangers or other appliances for hanging cards, frames, charts, etc., to walls of buildings.

Inquiry No. 9282. Wanted the name and address of a manufacturer who can make a small or large quantity of sugar bowls with trade marks incorporated therein.

Inquiry No. 9283. Wanted the name and address of a manufacturer who can make clock movements suitable for fly trap. They must be furnished at low cost and must operate a clock for a period of from two to four hours, or more.

Inquiry No. 9284. Wanted the name and address of a Company that can manufacture a combined toothpick and toothbrush made of special wood.

Inquiry No. 9285. Wanted the names and addresses of manufacturers of machines used for perforating music rolls for automatic pianos.

Inquiry No. 9286. Wanted a device to prevent eavesdropping on party telephone line.

Inquiry No. 9287. Wanted the name and address of manufacturer of composition roofing suitable for freight cars that will stand reasonable wear and tear, and for extreme variations of summer and winter climate.

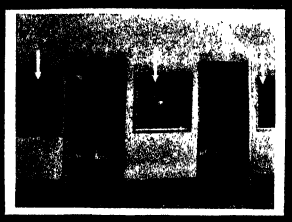
Inquiry No. 9288. Wanted the name and addresses of manufacturers of a fiber board, which is absolutely smooth on both sides, not subject to warping, and free from any impurities such as wood or other small irregularities. Boards should come in sheets 4 ft. wide by 6 ft. long, and run from 1/16 to 1/4 of an inch in thickness, and must be reasonably strong. Wanted to know the cost per square foot for what was required, only the amount is too prohibitive to make its use practicable.

Inquiry No. 9289. Wanted the name and address of a manufacturer who can make a machine for cutting off pig in such a manner that the ends of the pigs will have a clean smooth appearance, and not be left ragged as they are when cut by the machines now in use. Wanted to know the cost of such machines, and the capacity per hour. Wanted to know the cost of machines for cutting off pig in such a manner that the ends will be left ragged, and the capacity per hour.

Inquiry No. 9290. Wanted the name and address of makers of plants for the manufacture of hydrogen gas from caustic soda and aluminum.







Westinghouse Electric

Motor Drive Gives Your Plant the Elasticity to Meet Every Manufacturing Condition

NOW that the world is looking to American manufacturers to supply its needs in many varieties of finished goods —the manufacturer who has the modern factory and equipment will be in position to grasp his opportunity.

With old fashioned machinery for operating his plant, the manufacturer, already running up to capacity, with a similar chance and the ambition to improve it would have to build a complete new plant.

The manufacturer whose plant is equipped with Westinghouse Motor drive has merely to add new machines and new motors as the business grows.

There is no questioning the economy of the Westinghouse method. Westinghouse motors are designed to give the most efficient service for the machine or group of machines on which they are to be used. They consume power in exact proportion to the work they are called upon to do.

They are built for long life. At the rate the manufacturer usually writes off his machinery for depreciation, the Westinghouse Motor is paid for long before there is a suspicion of actual depreciation in its work or ability to work.

There is service value as well as physical value in Westinghouse Motors. When you purchase equipment upon which is the Westinghouse name, you also get the full benefit of the Westinghouse organization's long experience. In other words, you automatically bring into your own business one of the most famous of the world's engineering bodies.

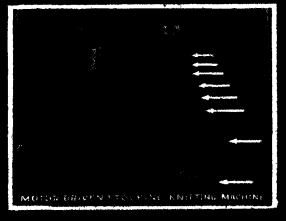
Before you even start to plan, talk to a Westinghouse Electric man.

Address Department B-J.

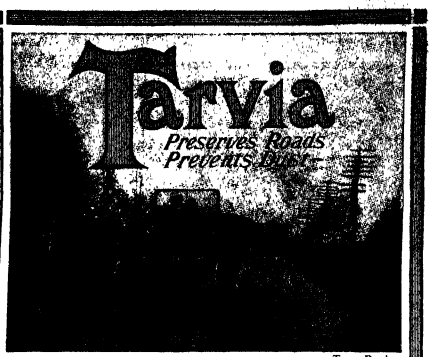
Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Penna.

Sales Offices in 45 American Cities **Representatives all over the World**









Tarvia Road, Middletown, R. I.

How to reduce your road taxes—

THE modern way to build macadam roads is to bond them with Tarvia, a dense, viscid, coal tar binder. It adds a little to the first cost of the road, but it saves a lot in the annual maintenance charges.

A Tarvia-bonded road will keep its contour for many years. It will shed water. Automobile traffic does not tear it to pieces. It produces little or no dust It does not ravel on grades, for the waterproof character of Tarvia prevents such damage.

After a hard winter the snow melts from the tarviated road and reveals the surface in good condition.

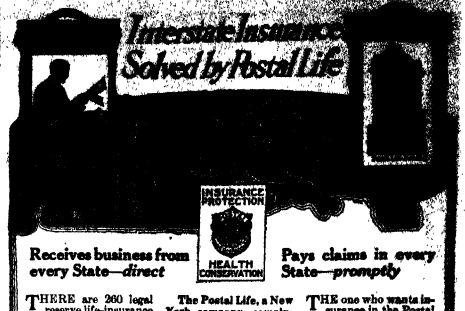
Tarvia has won its way among up-to-date engineers simply on the basis of the money which it saves. Town after town has learned that it can reduce the cost of its highways by the steady extension of Tarvia treatment.

The art of road building has now reached a point where the dusty road is in itself proof that the road is wasting the taxpayers' money, because it cannot withstand modern traffic.

Booklets on request.

BARRETT MANUFACTURING COMPANY
New York Chicago Philadelphia Boston St Louis Cleveland Cincinnati Pittsburgh Birmingham Kansas City Minneapolis Seattle

THE PATERSON MF'G CO., Limited: Montreal Toronto Winnipeg Vancouver St John, N B Halifax, N.S. Sydney, N.S



Receives business from every State—*direct*

Pays claims in every State—*promptly*

THERE are 260 legal reserve life-insurance companies in the country, all operating through agents, yet only 33 of these companies do business in the State of New York.

Similarly, of the largest four New York companies—"the giants," so-called—**not one does business in Texas; two of them do not enter Wisconsin, and the fourth does no business in ten States.**

The States will not let agents solicit business unless their companies take out licenses, pay so-called "occupation" taxes, and submit to other State exactions, which some companies can not, or will not, do.

The Postal Life, a New York company, complying with all the strict requirements of that State, is the only insurance institution that receives business from *every State in the Union*, thus enabling everyone to arrange insurance direct.

The POSTAL is, in quite a true sense, **an interstate institution**, and it can transact an interstate business, **because it is a non-agency company**; it employs no agents and does not send them into the various States.

It is therefore exempt from the various expensive requirements applicable to companies employing agents and agencies. *Postal policy holders get the benefit.*

THE one who wants insurance in the Postal Life writes, as a citizen of the United States, direct to the Company's New York headquarters—in its Home Office Building shown above—its only place of business. The Postal answers by mail, employing the usual Government facilities, and it is thus subject to the United States Postal authorities—also to the Federal Courts.

Uncle Sam brings letters from applicants, wherever they live, and takes the Company's answers wherever they are directed.

Insurance is thus arranged and policy-claims are paid by check mailed *direct* to the beneficiary—and *promptly*.

STRONG POSTAL POINTS

First: *Old-line legal-reserve insurance*—not fraternal or assessment

Second: *Standard policy reserves*, now more than $9,000,000. *Insurance in force*, more than $46,000,000.

Third: *Standard policy provisions*, approved by the State Insurance Department

Fourth: Operates under strict State requirements and subject to the United States postal authorities.

Fifth: *High medical standards* in the selection of risks.

Sixth: *Policyholders' Health Bureau* arranges one free medical examination each year, if desired.

See How Easy It Is

In writing simply say: *Mail me insurance particulars for my age as per the* Scientific American for September 8th.

In your letter be sure to give

1. *Your Full Name.*
2. *Your Occupation.*
3. *The Exact Date of your Birth.*

No agent will be sent to visit you: the Postal Life dispenses with agents, **you get the benefits of the agent's commission** because you deal **direct**.

Postal Life Insurance Company

Wm. R. Malone, President

35 Nassau Street New York

Net Cost Low in the POSTAL Bonus

1st. Commutation Dividends corresponding to agent's commissions, less the moderate advertising charge, go to Postal Policyholders the first year

2d. Renewal-Commutation Dividends and Office Savings, covered by the

9½%

guaranteed dividends go to Policyholders in subsequent years.

3d. Beginning at the close of the second year, **Contingent Policy Dividends**, based on the company's earnings, still further reduce the cost each year after the first.



WE TEACH Retail Advertising, Window Trimming, Show Card Writing, Salesmanship

In order to acquaint you with our sound methods of instruction, we will mail you *free* our new fifty cent book, entitled

TEN DISPLAY MANAGERS TELL

How To Sell It

With this free book we will also include our complete list of over one hundred fifty business books, especially suitable for one to use in his owne's library. A postal request will bring both.

Economic Training School 231-243 W 39th St., New York City

ELECTRIC LIGHTING FOR AMATEURS

How a small and simple experimental installation can be set up at home. Scientific American Supplement 1551. Price 10 cents. For sale by Munn & Co., Inc., and all newsdealers.

SYDNEY, AUSTRALIA
HONOLULU—SAMOA—SOUTH SEAS

The comfortable and pleasant route across the Pacific, winter or summer, is via *THE SYDNEY SHORT LINE* (10 days to Sydney). Splendid 10,000 ton American steamers (Lloyds 100 A1) sailing from *San Francisco* every two weeks for Honolulu and every *28 days for Sydney*.

$110 HONOLULU (Steerage extra) **SYDNEY $300**

Honolulu is the most attractive spot on entire world tour. Swimming, surf boarding, etc., at Waikiki Beach "beats them all." The world's greatest living volcano, Kilauea, can be reached by side trip.

SPECIAL TOUR SOUTH SEAS, 1915—Honolulu, Samoa, Australia, New Zealand, Tahiti, etc.
Various other tours, including *Java, China, Japan, and Around the World.*
Send for folder.

OCEANIC S. S. CO., 673 Market St., SAN FRANCISCO



Red Devil No. 1650

¶ This is a beaded heavy side cutting plier, with tool is used in many a good bond covering two years of service. ¶ The head is light and small and the handles are forever solid, assuring a perfect balance. ¶ The cutting edges are scientific design that fit the hand splendidly. ¶ You need it in your every day use. ¶ If your dealer can't supply you, send $1.75 to us and we will send you one only of No. 1650 block. We will present you genuine leather wristband.

Send for Booklet of 2000 Red Devils.

SMITH & HEMENWAY CO., Inc.
150 Chambers Street, New York, N. Y.

EPICYCLIC TRAINS, which play an important part in toothed gearing, are ably described in Scientific American Supplement 1524. Price 10 cents. For sale by Munn & Co., Inc., and all newsdealers.



Holds Stucco, Plaster or Cement as it can't crack, crumble or loosen. Saves 35 to 50 cents. Requires no skilled labor to lay other material. Makes construction permanent. Has withstood severest tests of building commission for years. [illegible]

HUDSON Six-40 1915 Model $1,550 This Year F.O.B. Detroit

Our Level-Best Six

This new HUDSON Six-40, despite its price, marks our level best. Our 48 engineers, headed by Howard E. Coffin, have devoted four years to the car. In reply to all conflicting claims—defending higher prices—that's the most that we can say.

This car is the climax of HUDSON ambitions. We may do better some time, but we can't today.

There is hardly a part or detail which we find a wish to better. In fine engineering, in beauty and comfort, in lightness and economy, this car comes near the apex, we believe.

We say this after thousands have been tested on the road. After 12 months' experience with our last year's Six-40. After noting all the new-year models which our rivals have brought out. And we believe that most men will agree with us.

Its 48 Designers

There are 48 men—there have been for years—on the HUDSON corps of engineers. And Howard E. Coffin heads them.

It has never been claimed, so far as we know, that there is an abler corps in the country. And certainly there isn't.

In HUDSON models—constantly progressing—these men have fought over-tax. They have warred with all excesses—in weight and price, in upkeep and operative cost.

And this HUDSON Six-40 for 1915 marks the final result of their efforts.

Do Opinions Differ?

There are arguments, of course, which combat ours. Each maker defends his own. But we doubt if well-informed men seriously differ about this car.

HUDSON advances have always been combated. But the records show that the general trend has followed where we led.

Sixes are almost universal now in the upper grade of cars. Lightness is now demanded. Economy has been studied. Prices have come down. And HUDSON innovations in beauty and equipment are being fast adopted.

The HUDSON Six-40 this year differs from its leading rivals merely in degree of progress. It simply leads the common trend.

Where Hudson Leads

The HUDSON Six-40 leads in lightness among cars of this capacity. it reduces old-time averages about 1,000 pounds.

This lightness, plus a new-type motor, gives it class-lead in low operative cost.

It leads in beauty. In numerous ways it leads all in new styles of equipment.

In the quality field it holds the low-priced record, for cars that compare in size, class and capacity. Since last year our trebled output has reduced the price $200.

And, in designing, skill—not luck—has given this car amazingly perfect balance.

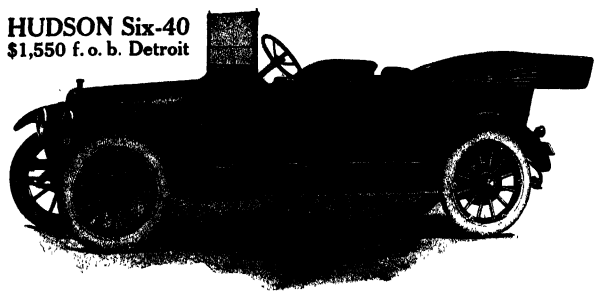
You'll Approve It

The more exacting you are, the better you'll approve this car. It will meet your conceptions in the things you want. In big ways and little ways it will show you to-day's best standards. We spent all last year on details and refinements.

Go see it, and bear this in mind: We build a larger car for the men who want it. But we could not, with our present knowledge, build a better car.

Hudson dealers are everywhere.
New catalog on request.

HUDSON Six-40
$1,550 f. o. b. Detroit



A perfect streamline body.
Seats and room for seven.
Disappearing tonneau seats.
Invisible hinges.
Hand-buffed leather upholstery.
Wide, high seats
Gasoline tank in dash. Tires carried ahead of front door.
"One-Man" top with quick-adjusting curtains attached.
Dimming searchlights.
Locked ignition and lights.
Simplified starting, lighting and ignition system.
Wires in metal conduits.
New-form speedometer drive.
New-method carburetion
Automatic spark advance.
Horn button in wheel
Trunk rack on back
Phaeton seats up to seven.
Also an ideal Roadster.
Also a beautiful Coupe.
Also a Limousine.

HUDSON MOTOR CAR COMPANY, 8186 Jefferson Ave., Detroit, Mich.

The Extra Guarantee

+Extra Experience
Extra Value
Extra Security
Extra Organization

INTO the crucible go the ideas of many men—of many firms—many great manufacturing centers—many countries. They melt and blend, and from their fusion comes a motor free of the dross of inexperience, of guess-work, of freakishness, —comes a fusion, clean, refined —a Continental Motor.

Continental Motors

Over one hundred firms—American and European—use the Continental Motor in some of its several models. Weigh the importance, the significance, of their combined O Kay! Judge the soundness of design that passes more than a hundred censorships; of the sureness of construction that five-score companies link their reputations with!

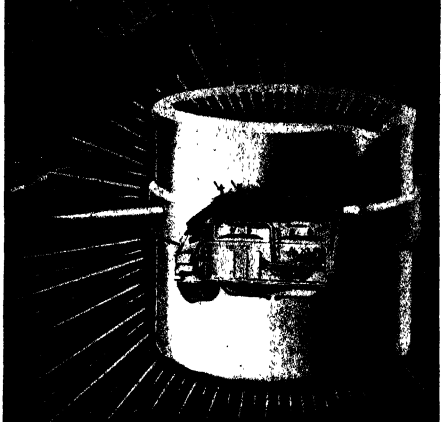
All the ideas of these skilled manufacturers are gathered. All that the leading engineers of two continents devise Into the melting pot they go—ideas American, English, French, Italian, German—ideas of firms large and small, Continental ideas—all!

And from it comes a Continental Motor.

No motor ever designed has had so broad a foundation in experience. Has had so many years of success behind it Has drawn so to itself the finest flower of the automobile industry since its very beginning.

Thus is the *extra* guarantee of experience that is back of every Continental Motor Demand it in the car or truck you buy.

Continental Motor Mfg. Co.
DETROIT, MICH.
Largest exclusive *motor* builders in the world
Factories: Detroit—Muskegon, Michigan



HOW TO BUILD A 5 H. P. GAS ENGINE AT HOME

In *Scientific American Supplements*, 1641 and 1642, E. F. Lake describes simply and thoroughly how a five horse power gas engine can be built at home. Complete working drawings are published, with exact dimensions of each part. Price by mail for the two Supplements, 20c. Order from your newsdealer or from MUNN & COMPANY, Inc. *Publishers* 361 BROADWAY, NEW YORK

Feeding the Man on the Firing Line

(Continued from page 185.)

2. By utilizing the resources of the country.

It is generally necessary to utilize to the fullest extent the food, especially the forage, available in the theater of operations. In former times the invader possessed the right of booty and pillage, the resort to which was most unfortunate for the army, as it embittered the population and compromised the safety of the troops in an enemy's country, and in the event of any real or imagined injury being done them, it gave rise to redress and reprisals. It furthermore caused the interruption of all commercial transactions, and stores were not offered for sale, as private individuals were compelled to submit their supplies to the rapacity of the enemy. These evils were in a measure remedied by not taking directly from private individuals, but by making upon the civil officials certain demands called requisitions, for a specified quantity of supplies necessary for the troops. The local authorities could apportion the demand among the inhabitants, according to the known means of each, or could procure the stores by purchase. The former practice of spoliation thus assumed the milder form of a war tax, regularly ordered and collected. This eventually led to the practice of giving receipts for the stores delivered, and the indemnity for the same was the next innovation. All these modifications were, of course, only introduced after a great interval of time.

Requisitions have been defined as demands for necessary supplies and services made on the inhabitants of certain districts or localities, *through their civil authorities*, to satisfy the requirements of an army. They are accompanied by force, if it is necessary to resort to such extreme measures, to exact the fulfillment of the demands.

During the Franco-Prussian war of 1870-1871, the Germans obtained by requisitions in France one third of the food supplies and forage required for their large armies, and the receipts given for these supplies stated that they would be paid for by the *vanquished*.

Billeting or Quartering.—Supplies of food are, as a rule, to be found for several days in every town or village, and each householder usually has a sufficient quantity to provide his family for a few days, consequently, at least the same number of soldiers as there are individuals in the household can obtain subsistence there for a day or two. This method is the one which distributes more uniformly, if not in the best way, the burden of the subsistence among all the inhabitants, and makes it possible to subsist the greatest number of men in a given section of a country.

An exception should always be made in favor of the poorer classes, who at the best of times, are barely able to provide for their own families.

The following exceptions are usually made:

First. Any householder who has entertained a wounded man in his house is "exempted from the quartering of soldiers." (Article V, Geneva Convention of 1864, acceded to by United States, March 1st, 1882.)

Second. Charitable institutions, hospitals, asylums for aged and infirm, religious communities of women, unprotected women, and educational institutions for girls should not have troops billeted upon them.

The advantage of this system is that the men at the end of a day's march find their meal ready cooked and prepared. The disadvantages are that it causes very great dispersion and separation of the different units. In addition, this method may lead to oppression on the part of the troops, if they are not treated as liberally as they consider they should be. The dispersion of the troops prevents the officers enforcing strict compliance with orders and is subversive of discipline.

A supply of uniform clothing must be provided from the home country, and a sufficient reserve available at all times to

Would You Spend Time on Two Years—and a Lot of Money—Testing Samples that Couldn't be Duplicated in Quantities When the Test was Finished?

The test wouldn't do you much good, would it?

NON-GRAN

NON-GRAN is the finest of all bearing bronzes for the resistance of frictional pull and wear. And NON-GRAN, *physically* as well as chemically, is uniform year after year.

If you can't visit our works, write us and ask us to explain how we insure this positive, year in and year out, uniformity of NON-GRAN.

NON-GRAN is the bearing bronze used in the manufacture of the

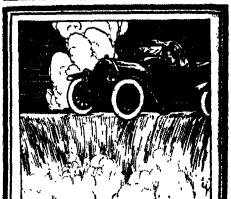
"PACKARD" ***"LOCOMOBILE"***
"SIMPLEX" ***"MARMON"***
"STEVENS-DURYEA" ***"SAURER"***

and the score of other cars that *stand up uniformly*.

NON-GRAN is the bearing bronze you can count on to back up, and make good, the design and workmanship on your machines.

Mail us blue prints of your bushings and get the unbiased counsel of our Engineering Department. This service is gratis to any manufacturer of machinery.

AMERICAN BRONZE COMPANY
840-900 CARTON BOULEVARD
BERWYN, PENNSYLVANIA



It's a safe bet you will never need to

Stop Your Car on the Brink of Niagara

BUT you can save yourself in many a tight place that would otherwise spell S-M-A-S-H—U-P and, perhaps, Death—if you have your brakes lined with

Thermoid HYDRAULIC COMPRESSED Brake Lining - 100%

When you set your brakes lined with Thermoid they take hold noiselessly—they grip—you STOP!

That's because Thermoid is brake lining from top to bottom—just as full of friction or gripping power in the center as on the outside—with 50% more material *in* it and 60% more labor *on* it than any ordinary lining.

Thermoid won't burn up on a long, steep, down-hill run. Oil, gasoline, water, heat, dirt, won't affect it and it will outwear any other brake lining, bar none.

Our Guarantee—
Thermoid will make good—or WE will.

Specify it on your 1915 car—order your repair man to put it on your car in service stock.

Thermoid Rubber Company
Trenton, New Jersey, U.S.A.

1915 Chalmers Cars

"Sixes" Exclusively



"LIGHT SIX" 5-PASSENGER—$1850

New body styles, refinements of detail, continued use of the well-tried Chalmers Chassis, and a slight increase in price. These are the striking features of the Chalmers line for 1915

The Chalmers "Light Six" is now offered in both five- and six-passenger types with new bodies of latest style and design—in every way a distinguished car. The five-passenger model is a big, roomy car in comparison with high-powered "Sixes," but not skimped in design.

The six-passenger model—at $1900—is a car of exceptional grace and roominess, with an entirely new, luxurious and distinctive body. The tonneau is fitted with Pullman disappearing seats. Doors are unusually wide. The body is a new type of exclusive Chalmers design.

This "Light Six" is the proved 1915 car. 4000 of these cars have been driven an aggregate of 3,000,000 miles and they have universally made good.

When we first announced this car we priced the five-passenger car at $1800. We have since added a few detailed improvements and made some changes which have increased the manufacturing cost approximately $50. So beginning August 1st the price of the five-passenger model became $1850. At the new price our factory profit remains the same.

The "Master Six" of Them All

The new 1915 Chalmers "Master Six"—$2400—will be produced in limited quantities for those who seek the fullest luxury of power and size in a motor car

For 1915 the "Master Six" is offered in two body types, the four-passenger Torpedo and the seven-passenger Touring Car. Both types are unusually beautiful and distinctive. The price of either type is $2400.

The four-passenger Torpedo is a most distinctive car. It has exclusive style and dash. This beautiful new body has a single door on either side. Front seats are divided, the doors being in the center of the body.

This is a man's car of universal style and smartness, built lower than usual, giving it a foreign, racy appearance and making it distinctive among other cars.

The "Master Six" seven-passenger Touring Car is a big, roomy car, for those who drive an automobile of maximum carrying capacity. The lines of the seven-passenger body are the same as those of the Torpedo.

Chalmers Cars—Quality Cars

"Quality First" will continue to be the guiding principle of Chalmers manufacture for the coming season. It is to carry out this principle even further than in the past that we have raised the Chalmers prices.

The Chalmers Company is not competing and never has competed with other cars on a "price" basis. Our past experience has shown us that each year there are enough people to whom "quality" is first and "price" secondary, to buy more Chalmers cars than we can make.

So the Chalmers Company is one of those sure enough of its market to continue to produce cars on a "quality" basis rather than on a "price" basis. The new prices, $1850 for the Chalmers "Light Six" and $2400 for the "Master Six," mean no more profit per car to us, but they mean to you even more value in the future than in the past.

See These Cars

Arrange with your local dealer to see these Chalmers "Sixes." Take a ride in the car that appeals to you most. Place your order early. The production of Chalmers "Master Sixes" is limited and will not fill the demand.

Quality First

Features of Chalmers "Sixes" for 1915

Chalmers Bodies—We call your attention especially to the Chalmers body designs for 1915. The bodies of both the Light Six and the Master Six are distinctly original. They have been pronounced by experts to compare favorably in looks with the best European cars to which the world always looks for exclusiveness of body design. The words "Genuine Streamline" are so much abused that we do not use them in describing Chalmers bodies. See the new models yourself; then you can appreciate how distinctive they are in grace and style.

Flexible Power—Both 1915 Chalmers "Six" motors are exceptionally long stroke. At two miles an hour on "high" or at express train speed, you feel the big reserve of pull and stamina. You never feel uncertain of a Chalmers "Six," and the need for gear shifting is rare.

Roadability—Chalmers "Sixes" ride well. They cling to the highest crowned road. That's because their weight is rightly balanced, because all torsion strains are taken up by big strong torque tube and rod. In building for strength and safety, Chalmers design leaves nothing to chance.

Molded Oval Fenders—Introduced by Chalmers last year and declared by owners "the handsomest fender built." Give fullest protection from dirt.

Tungsten Steel Valves—Will not warp or pit. Almost never need regrinding. Assure full and lasting power. Cost more, but are worth more

Medium Weight—Both Chalmers "Sixes" are designed for lasting and satisfactory service. They are heavy where weight is needed, and do not carry a superfluous pound. In proportion to power, as economical as any. Heavy enough to be safe in any emergency, comfortable on any road

Complete Equipment—All open cars have electric starter, Chalmers tailor made top, rain vision windshield, Klaxon-made horn, demountable rims, full electric lights. No car carries better equipment or is more convenient



"MASTER SIX" TORPEDO—$2400

"Master Six"	4-Pass. Torpedo	$2400
"Master Six"	7-Pass. Touring Car	2400
"Light Six"	4-Pass. Touring Car	1850
"Light Six"	6-Pass. Touring Car	1900
"Light Six"	2-Pass. Coupelet -	2100
"Light Six"	4-Pass. Sedan - -	2850
"Light Six"	7-Pass. Limousine	3300

Fully Equipped (F. O. B. Detroit)

Please send me literature on the 1915 "Light Six" and the 1915 "Master Six"

Name

Street Town

State

A.A. 9-5-14

Chalmers Motor Company, Detroit

Trouble-Savers

For the Users of No-Rim-Cut Tires

These are four of the greatest features ever employed in tire making.

Each combats, in the best way known, one of the major tire troubles.

All four are exclusive to Goodyear No-Rim-Cut tires. That is why these tires rule. No other tire in the world to-day has so many users.

The Four

To end rim-cuts, these tires alone have our No-Rim-Cut feature. It completely wipes out this chief cause of tire ruin, in the only satisfactory way that's known.

To save blow-outs—to remove one of the main causes of them—we give these tires an "On-Air" cure at an extra cost of $1,500 daily. No other maker does that.

To combat loose treads, we form in each tire, by a patent method, hundreds of large rubber rivets. They reduce this risk 60 per cent.

For an anti-skid we give you our double thick All-Weather tread. It is flat and smooth and regular, so it runs like a plain tread. But it grasps wet roads with deep, sharp, resistless grips.

You Want Them

You want these trouble-savers. Every motorist wants them. This is to urge you to get them.

Hundreds of thousands get them now in Goodyear No-Rim-Cut tires. No man gets them in any other tire.

You get with them in Goodyears, in every way, the utmost in quality tires. And you get them at prices which mammoth production has reduced to the farthest limit.

They mean to you safety, sturdiness, strength—maximum mileage and minimum trouble. And any dealer, if you ask him, will supply you these premier tires. For your own sake, get them.



THE GOODYEAR TIRE & RUBBER CO., Akron, Ohio

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Branches and Agencies in 103 Principal Cities (1915) Write Us on Anything You Want in Rubber



Saves Its Cost Quickly

Oxy-Acetylene welding offers a saving in manufacturing costs:

(1) In uniting parts quickly, as strong as the metal itself.
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Every manufacturer should have our information bulletins on this process. It will show a big saving in your business.

Prest-O-Lite For Oxy-Acetylene Welding & Cutting

makes the outfit portable, cheaper in first cost, cheaper to operate, never depreciates in value, and saves time and money in every operation. It gives greater heat and because of the purity of the gas makes stronger, better welds. Stored in cylinders, it is backed by universal service.



No matter what outfit you employ, no matter what use you make of acetylene, Prest-O-Lite acetylene service means the maximum of quality, convenience, safety and economy.

Let us send you interesting data on Prest-O-Lite welding and our proposition on Prest-O-Lite acetylene service. You'll need this some time—why not write today?

The Prest-O-Lite Co. INC.
810 Speedway, INDIANAPOLIS, IND.
Branches and Charging Plants in All the Principal Cities.

Backed by the Prest-O-Lite Service

The Prest-O-Torch (Acetylene Blow-Torch)
Takes the place of the gasoline blow-torch for soldering, brazing, tempering tools, etc. Safer, surer. Costs less to buy and less to operate. Gives greater heat in a concentrated flame. Perfectly convenient. No repair expense. Absolutely safe. Complete information on request.

replace the losses which occur in active service. In some of the foreign armies the first reserve of clothing is composed of 10 per cent of trousers and shoes, 5 per cent of caps, coats, and overcoats. These percentages are calculated on the maximum war strength of the organization. In those armies every soldier's kit must at all times contain an absolutely new uniform; this uniform the man is required to put on only when the order for mobilization is received. The troops, consequently, march into the field in new clothing, which arrangement very greatly reduces the demands upon the reserves during the campaign.

A study of the orders given by Napoleon indicates the care he exercised to have a sufficient supply of shoes provided. On one occasion he wrote, "You know that shoes are always needed in war"; and at another time he said to Baron Lejeune, "Shoes help on marches, and marches win battles." To Sir John Burgoyne's question addressed to Wellington, "What was the first requirement of a soldier?" "A good pair of shoes," he replied. "And the second requirement?" "A good pair of shoes for a change." "And the third?" "A pair of soles for repairs."

In the foregoing discussion attempt has been made to outline in a very brief and cursory manner the supreme importance of the supply of an army in the field and the stupendous task imposed upon the officers charged with the execution of the same.

The results of a campaign are gaged by the victories and other feats of arms, which are exhaustively described by the many participants therein, but it is very seldom that adequate credit is accorded the efforts of the administrative officers who indirectly contribute very greatly to the successful issue, although the work of such officers never ceases, and cannot flag for one instant. When the army is on the march the supply departments are strained to their utmost to provide its wants, and when it halts to recuperate its strength, the same unremitting care and attention must be given by the administrative officers. As Daru says: "This is perhaps the only service which takes no rest during war."

The Nerves of an Army

(Concluded from page 167.)

try test, is now placed in the National Museum as a monument to that pioneer achievement, and should be an incentive to this country to regain its pre-eminence in aeronautical progress. Within the limited means at its disposal, the Signal Corps in the five years since aviation began, has been training the few officers whose services could be spared under former provisions of the law. It has acquired sufficient biplanes from American aeroplane manufacturers for the limited training possible. Under the more liberal provision of officers and men now made in the law, and the correspondingly increased appropriations hoped for, rapid strides will be made in securing modern high power machines and the skilled aviators to run them. Under recent War Department orders, an aviation organization is authorized, called a "squadron." This is divided into two companies. Each of these companies is equipped with four aeroplanes. Each aeroplane and its appurtenances, with the necessary personnel, constitute a section. The aeroplane squadron consists of twenty officers and 90 men. To supply, keep in repair, and transport the eight aeroplane sections and the headquarters, sixteen automobile "tractors" and six motorcycles are proposed to be used. These automobile tractors transport the personnel, the dismounted aeroplanes, spare parts, and the necessary fuel (gasoline and oil). Included among the tractors is a portable machine shop. Such an aero squadron is considered the necessary tactical unit to serve with a division, having in view its best employment as a means for collecting and transmitting information.

In the foregoing general statement, the field duties of the Signal Corps are only briefly touched upon. An extensive system of coast information and patrol stations, involving radio and [illegible] line communication, will be established in time of war, [illegible] doubtedly depend upon [illegible] control. The Signal Corps would also be called upon to lay and operate submarine cables and operate cable stations, as it does in the peace establishment, in connection with the cable system from Seattle northward to Alaskan ports. It would provide and distribute the code and cipher systems so important in modern war, especially since the extensive employment of radio-telegraphy. In conjunction with other arms, the collection of photographic data by the Signal Corps, especially with improved field tele-photo apparatus now devised, will be most important for map and other graphical information.

From Fighting Line to Hospital

(Concluded from page 168.)

Here he observes many cases being brought in; an operating table has been improvised by placing a litter on top of four posts, and some operating is going on. He is told that under the tent flies pitched a short distance away are numbers of seriously wounded. At length four ambulances arrive and he, with others, is placed in one, and after riding an hour over a rough trail he arrives at the field hospital, which is in tents, no buildings being available. This hospital has a capacity of two hundred and sixteen beds. Here a careful record is made of his case; he is taken into a ward tent, his soiled and bloody clothes are taken off, he is given a suit of pajamas, and placed on a bedsack filled with straw and laid on the ground. He is furnished with a pillow and blanket, and a rubber blanket to use in case of rain. Light diets are served the patients. The hospital rapidly fills up, and just at dusk he is again placed in an ambulance and turned over to a Medical Officer, who verifies carefully each of the occupants of the ambulance and the property he carries with him, for the reason that Private B here passes out of the control of the Division Commander and into the jurisdiction of the Line of Communications. After an hour's ride he arrives at the Evacuation Hospital, which has a capacity of three hundred and twenty-four beds. Here he finds comfortable cots, abundant bedding and food. The next morning he is placed on a hospital train and conveyed to the base, where he finds himself in a hospital of five hundred bed capacity, with skilled physicians, trained female nurses, and an abundance of supplies of all kinds. Here he makes an uneventful recovery, and after spending ten days in the convalescent camp, returns to his regiment.

It will be noted throughout this statement of these plans that there is no mention made of the regimental hospital of former days. The old policy permitted the retention of sick at the front, encumbering the movement of troops. The present plan, which is now adopted by all the great powers, contemplates sending all sick to the rear, where facilities are abundant and where they can receive better attention than was ever possible when they were retained with their regiments.

Aircraft in War

(Concluded from page 172.)

Army Exercises. On page 172 a list of Zeppelins is given, in which army, navy, and passenger carrying vessels are included, and which is about as accurate as can be compiled at the present time. The list includes only vessels which are actually available and ships which can be finished in a few weeks.

From these tables it will be seen that most of the German airships of whatever type have speeds well above 45 miles an hour. The actual number of airships which Germany has at the present time available is not less than 32.

Just what the German aeroplane strength is—or for that matter the aeroplane strength of any power—is a matter of guessing. When it is considered that the flying machine of to-day can be produced in quantities as literally and seriously as a torpedo, statistics of flying machines



3,243 plants are now filled with this sunshine

The Electrical Testing Laboratories, New York, found that Rice's Gloss Mill-White gave 19% to 36% more daylight, depending upon the conditions in the plant. (Read the Kellogg letter in box below.)

It *reflects* the light, instead of absorbing it. It throws daylight into dark corners. It saves greatly on electric lighting bills. It enables employees to work better, because they can *see* better. Moreover, it is the most sanitary interior paint. It can be *washed* with soap and water, without killing the gloss.

Because it stays white longer than any other gloss paint, Rice's Gloss Mill-White requires *less frequent repainting*. Another striking economy and convenience is that *it can be applied over cold water paint.*

Below are a few letters, out of literally hundreds, telling what it has done. Still stronger proof that it is best can be secured *in your own case*, by our open guarantee. Now is an opportune time to repaint; we invite stringent comparison of Rice's Gloss Mill-White with every other interior finish.

A Few of Many Users

General Electric Co.
Pierce Arrow Motor Car Co
Ford Motor Car Co., Detroit, Mich
Eastman Kodak Co., Rochester, N Y
Gillette Safety Razor Co., Boston, Mass.
Chatfs Peabody & Co., Troy, N Y
Royal Typewriter Co., Hartford, Conn
General Fire Extinguisher Co., Providence, R I
Waltham Watch Co., Waltham, Mass
United Shoe Machinery Co., Beverly, Mass.
Seaconnet Mills, Fall River, Mass
Lancaster Mills, Clinton, Mass.
Whitin Machine, Whitinsville, Mass.
New Nashawena Mill, New Bedford, Mass
Graniteville Mfg. Co., Graniteville, S. C
West Point Mfg. Co., West Point, Ga.
Quisett Mills, New Bedford, Mass
Berkshire Cotton Mfg Co., Adams, Mass
Foster Machine Co., Westfield, Mass
Bullard Machine Tool Co., Bridgeport, Conn
Massachusetts Mills in Georgia, Lindale, Ga
The Pell City Mfg Co., Pell City, Ala
Indian Head Mills of Alabama, Cordova, Ala
Pelzer Mfg. Co., Greenville, S C
Waterbury Farrell Foundry and Machine Co, Waterbury, Conn
Tremont and Suffolk Mills, Lowell, Mass
Whitman Mills, New Bedford, Mass
Diamond Chain and Mfg. Co., Indianapolis, Ind
Chadwick-Hoskins Co., Charlotte, N. C
Merrell-Soule Co., Syracuse, N Y.
Brighton Mills, Passaic, N. J.
Renfrew Mfg. Co., Adams, Mass.
Hood Rubber Co., Boston, Mass.
Greylock Mills Co., N. Adams, Mass
Utica Steam and Mohawk Valley Cotton Mills, Utica, N. Y.
Dwight Mfg. Co., Chicopee, Mass., and Alabama City, Ala.
Wm. A. Slater Mills, Jewett City, Ct.
Fall River Bleachery, Fall River, Mass.
Edwards Mfg. Co., Augusta, Me.

Why it is better than imitations

Rice's is the original Mill-White, all others are imitations and they can imitate only for a short time. For this *is the only Mill-White made without varnish* For that reason it does not crack and scale like others; it does not flake off with the jar of machinery It is made by a special process, *discovered and owned exclusively by the makers* There can positively be no substitute which gives as good service

Imitation "Mill-Whites" may look as good when *first* put on But six months' exposure will prove their inferiority By that time many are so yellow that they might be yellow paints. Repeated tests have shown, *without a single exception*, that Rice's remains white longer than any other.

Guaranteed to Remain White Longest

These are far from being mere claims. We give an unequivocal guarantee, with every trial, that if Rice's does not remain white longer than any other gloss paint—applied at the same time and under similar conditions—we will give free enough Rice's to repaint the job with one coat We give a similar guarantee that Rice's will not flake or scale In other words, you can prove our claims, in your own case, *at our risk*. You cannot lose under these guarantees.

Even more liberal test offers will be made to those having 20,000 square feet or over to cover Tear out the coupon now, and give it to your stenographer, with instructions to "write on our letterhead, and have the reply come to me personally" We will send complete information and sample board

One coat of Rice's Granolith makes best possible primer on inside concrete and brick, for a second coat of Rice's Mill White

RICE'S GLOSS MILL-WHITE

U. S. Gutta Percha Paint Co.

23 Dudley Street **Providence, R. I.**

What a Few Users Say

Sanitary conditions in our plant have improved wonderfully We should judge we are getting 50% more light than before — Kellogg's Toasted Corn Flakes Co., Battle Creek, Mich

We are indeed astonished to note the vast amount of daylight created by this paint - especially where we were formerly forced to use electric lights all day Now find it entirely unnecessary Agreeably surprised to observe how easy it is to keep clean — Knotair Hosiery Co., Philadelphia, Pa

The most practical interior finish we have ever used on walls and ceilings We imagine we will show an increase of between 20 and 25% in light — R. J. Reynolds Tobacco Co. (Makers of Prince Albert)

Find it very satisfactory indeed — Gillette Safety Razor Co

The best thing we know of — H Doherty Silk Co., Paterson, N J

Tested it in competition with several other makes "The architect and owners respectively, Mr Pitt and Canadian Yale & Towne Co agree that yours is the best in appearance — F Hilford, Niagara Falls Ont

Still pleased with the finish which was applied three years ago It is as new and permanent condition as when applied General Fire Extinguisher Co., Providence, R I

Out of six comparative tests, Rice's Mill White leads Killingly Mfg Co., Killingly, Conn

We gave your paint a severe test in connection with several brands and your paint stood the test the best and gave complete satisfaction — The American Pin Co., Waterbury, Conn

Tear out this coupon as a reminder to have your stenographer plus write us on your letterhead for further particulars of *Rice's Mill White*, stating approximate size of main building etc.

Approx length ___ Approx width ___

Number of Stories ___

Company ___

Address ___

Attention of ___

Light your plant with daylight



The scene below is a striking example of the difference a little paint makes inside of a factory.

Only one coat of Lowe Brothers Mill White has been applied to the farther part of the room—but see how much lighter it is. You can get the *same results* in your plant, with

Here's a better Mill White

Lowe Brothers Mill White is the kind of paint you'd expect to come from this house of quality. It's specifically made for its purpose.

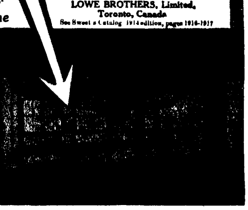
It works well, spreads freely, has rare covering and hiding power in flat or gloss (even one coat of it will do wonders); it is washable and after wearing a long time, leaves a fine surface for repainting.

Get our book and get the whole story

Be sure to get the book before placing any orders for Mill White. It tells how and why Lowe Brothers Mill White is efficient—economical.

Give us an idea of the amount of surface you wish to cover and we'll arrange to make you a quotation.

Write us today



Lowe Brothers Mill White

It will reflect and radiate the light that comes through the windows—multiply your daylight—give your men better working conditions, save them time and eye strain, save yourself gas and electricity bills.

The Lowe Brothers Co.
474 E. Third St., Dayton, Ohio
Boston Jersey City Chicago
Kansas City Minneapolis
LOWE BROTHERS, Limited,
Toronto, Canada
See Sweet's Catalog 1914 edition, pages 1916-1917



The
Autographic Kodak

Date and title your negatives permanently, when you make the exposures.

EVERY picture that is worth taking is worth a date and a title. The places you visit—interesting dates and facts about the children, their age at the time the pictures were made—the autographs of friends you photograph—these notations add to the value of every picture you make. Architects, engineers and contractors who make photographic records of progressive work, and the amateur who wants to improve the quality of his work can make notations with dates on the negatives, by means of the Autographic Kodak.

Just release a stop and a door opens in the back of the Kodak; write whatever notation you want, expose from 2 to 5 seconds; close the door and you are ready for the next exposure. On the margins between the negatives will appear a permanent photographic reproduction of the notation you made, and this can be printed or not, just as you choose.

The greatest photographic advance in twenty years.

No. 3A Autographic Kodak, pictures 3¼ x 5½ inches, ... $22.50
No. 3 Autographic Kodak, pictures 3¼ x 4¼ inches, ... 20.00
No. 1A Autographic Kodak, pictures 2½ x 4¼ inches, ... 17.50

EASTMAN KODAK COMPANY,
At all Kodak dealers. ROCHESTER N Y *The Kodak City.*

mean little. [illegible] that which is now raging, the statistics, if they were known with any accuracy, would probably be found to change from month to month.

Germany's development of the military flying machine, however, is remarkable. France had incorporated the flying machine into *her army a full year before* the great General Staff of the German Empire determined to follow the French example in 1911. The steady growth of the dirigible, above all of the Zeppelin, and the lack of an aeroplane industry at all comparable with that built up in France in 1909 and 1910, were no doubt the chief reasons for this tardiness. In the brief space of three years, Germany has not only caught up with France, but may even have surpassed her. The best evidence of that is to be found in the new world records which have been made by German aviators—records which could not have been made without superb machines. To stimulate industrial interest in aviation the government as well as numerous private organizations offered prizes for machines and engines. It is interesting to note that many of the prizes were awarded for purely technical triumphs. In a single year (1912) the German public subscribed $1,750,000 for aviation. The amount of flying that is being

[illegible] of 300,000 cubic [illegible] have only a capacity of [illegible] The German dirigibles [illegible] 300 horse-power. [illegible] a speed of 50 to 60 miles [illegible] dirigibles scarcely have a [illegible] 35 miles an hour, and [illegible] attain a speed of 45 miles [illegible] of the German destroyers [illegible] and can be used effectively [illegible] tions. They can carry [illegible] and 8 tons of weight, [illegible] and a half of ammunition [illegible] supplied with machine guns. [illegible]

"France has nothing to [illegible] . . . In 1911 France drew [illegible] gramme of dirigibles. It [illegible] heavy cruisers, light cruisers, [illegible] But, alas! in the following [illegible] that the light cruisers and [illegible] not be of great service. [illegible] was therefore abandoned, [illegible] in November, 1912, to build [illegible] ers with a capacity of 24,[illegible] each. Four of them were to [illegible] October, 1913, and three oth[illegible] 1914. At present not one [illegible] is completed. Only three of [illegible] ing and may be finished in a few [illegible] the construction of the other fo[illegible] been commenced."

The Senator's remarks are [illegible] severe. His estimate of the German [illegible] ship strength as well as that of France [illegible] somewhat low, although he probably [illegible] in mind craft actually constructed and [illegible] ing, whereas our tables include also [illegible] sels which can be made available for [illegible].

FRENCH AIRSHIPS.

S. r. denotes semi-rigid; r., rigid; n r, non-rigid.

Name.	Make.	Date	Displacement in tons	Length in feet.	Diameter in feet.	Speed in miles per hour	Total [illegible]
Astra XVI. (n. r)	Astra Co	1914	38 0	?	?	60	1,000
Astra XV (n r)	Astra Co....	1914	23.0	394	52	60	1,000
Conte (n r.).	Astra Co.....	1913	9 1	270	49	40	400
Lt. Chauré (n. r.).	Astra Co.......	1911	9 0	285	49	32	320
Adj. Reau (n r)	Astra Co	1911	9 0	285	40	32	240
Col Renard (n. r.)	Astra Co ..	1909	4.5	215	35	27	110
V. de Paris (n r.)	Astra Co....	1906*	3.5	200	32	22	70
Dupuy de Lome (n. r.)	Clement-Bayard	1912	9 0	290	55	35	240
Adj. Vincenot (n r.)	Clement-Bayard	1911	9 0	290	55	35	240
Capt. Marchal (s r)	Lebaudy....	1911	10 0	293	51	28	100
Lt Selle de Beauchamp (s r.)	Lebaudy....	1910	7 0	280	51	28	160
Liberte (s. r)	Lebaudy.	1910	7 0	280	45	33	160
Spiess (r.)	Zodiac........	1912	20 0	459	47	45	400
Capt. Ferber (n. r)	Zodiac	1911	6 0	249	43	35	230
Com. Coutelle (n r.)	Zodiac.	1911	9.5	303	49	38	400
Le Temps (n r.)	Zodiac.	1911	4 0	160	30	20	110
Fleurus (n r)	Government .	1912	6 5	252	41	36	160
Clement-Bayard VI (n r)	Clement-Bayard	1913	6 5	245	41	40	360

* Rebuilt 1908

done may be judged from the high aviation death rate—higher than that of any other country in Europe—as well as the experimental character of many of the latest inventions.

It is impossible even to state the number of machines which the German army can count upon. In a general survey of the aviation strength of Germany made for the London *Times* in 1913, by a special correspondent who visited the European aeroplane shops and gathered his information at first hand, the number of German machines is placed at not less than 200 or more than 250. That was over a year ago, and in a year a country so technical and martially active as Germany can do much. The German army is usually credited with 600 aeroplanes, which includes all the private machines that can be commandeered in time of war. That is probably too high; 500 is nearer the truth.

France as an Air Power.

Last January Emile Reymond, the most competent authority in the French Senate on military aeronautics, made some extraordinary revelations, which, if true, would place France far below Germany as an air power. In our opinion he has underestimated the French dirigible equipment. It is probably inferior to the German, not only in quality, but in organization; but it is much more effective and serviceable than he would have it, as the brilliant success that it achieved in the last maneuvers adequately proved. Senator Reymond's comparison may be here quoted with propriety, coming as it does from a French official, who happens at the same time to be an excellent pilot himself:

"Germany possesses fourteen dirigibles, of which seven are Zeppelin airships, capable of being used as destroyers. France has only

It is evident from the foregoing table that the French army airship material is rather of a varied character. The speeds are much lower than those of the German dirigibles. It is doubtful if most of the French ships can be effectively used in daylight warfare. The average aeroplane speed is much higher than the average French dirigible speed, which simply means that in daylight an aeroplane could out-maneuver nearly all French airships and subject them to fire.

The aeroplane strength of France is more accurately known than that of any other European Power, thanks to a controversy which was the direct outcome of the great National Aeroplane Subscription inaugurated some two years ago. It was alleged that the machines bought for the army were not new and that the orders for new machines fell short by two hundred of the number voted. While some manufacturers undoubtedly did seize the opportunity of foisting on the government aeroplanes of an old type, and while all the machines voted were not actually delivered, chiefly because of the limited output of some makers, the charges of dishonesty were not justified. The investigation made because of the controversy showed that 751 aeroplanes have been added to the aeronautic establishment of the French army during the past two years, and about 1,000 machines since the beginning of 1911. Because flying machines deteriorate rapidly, and because new types have been evolved for military use—types which are much faster than the monoplanes and biplanes used by officers in 1911—the effective aeroplane strength of the French army at the present time cannot be less than 500 first-class flyers.

Great Britain and the Air.

The British public has been taught to



"The final saving possible with the universal use of Armco Iron for all purposes requiring rolled or drawn metal, would compare favorably with the amount America could save by cutting out all her unnecessary fire losses"

—from Story of Armco Iron "Defeating Rust."

AMERICAN ARMCO INGOT IRON

ARMCO Iron Resists Rust

Our chemists save millions for the public

OVER one hundred million dollars' worth of sheet metal is made each year in this country. Most of it disappears shortly on account of rust. This is due to the fact that most sheet metal of the present day contains impurities such as carbon, manganese, silicon, copper, sulphur; therefore it cannot help rusting when exposed to air, moisture or corrosive gases.

Our chemists are saving millions of dollars for the public as a result of the discovery of two things: first, government experts established that the rapid corrosion of steel was due to its high content of impurities, especially manganese; second, we found the way to make pure iron. Either of these discoveries ranks as one of the greatest achievements in metallurgy.

Pure Rust-Resisting Iron Will Save Millions

Let us illustrate this saving of millions, literally. In a decade, most of the impure sheet metal made in 1914 and used in exposed situations will have been destroyed by rust. The sheet steel made in 1904 has mostly rusted away. There you have a complete, annual loss of nearly one hundred million dollars.

But as soon as the public realizes and accepts the great truth that pure iron is a resistant to rust, there will of course be little sheet metal used except pure iron. When that time comes, a waste of millions of dollars will be wiped out.

These are big figures, big claims—but they are true. Perhaps little figures will mean more to you. Let us say it will cost you $100 to roof a building with metal shingles or sheet metal. Ten years is about as long as you can count on modern impure metal roofing lasting. That is a cost of $10 a year. Pure iron roofing should last many times ten years. Even the old-fashioned charcoal iron roofs lasted forty to seventy years, and that iron was not as pure and not as rust-resisting as the pure iron which we are making. So instead of $10 a year, the cost of your roof will be nearer $2 a year.

Apply the same method of figuring savings to other sheet metal products; to metal window frames, metal lath, ventilators, gutters, pipes; especially to stoves, boilers, ranges and furnaces, which are peculiarly subject to rust, owing to condensation of moisture and to corrosive gases; to refrigerators; to road culverts, metal cars, boats, flumes, smoke stacks, tanks, woven wire fences and the thousand and one other things made from rolled or drawn metal.

ARMCO Iron Is Pure

Armco Iron is not only pure, rust-resisting—it is an exceedingly fine quality of metal for other reasons. Every process of manufacture is handled with extreme care and is under the supervision of very highly trained metallurgists. For instance, each sheet, after rolling, undergoes a slow annealing process which takes a week, although ordinary sheet metal is often annealed in a day. Slow annealing restores all of the original strength and evenness of texture and removes molecular strains caused by rolling. For this reason, Armco Iron is very ductile.

Armco Iron, when galvanized, shows practically no dissolution when the zinc is applied; therefore the zinc is not impregnated with iron particles and lasts much longer than the coating on an impure base.

The trademark **ARMCO** carries the assurance that Iron bearing that mark is manufactured by The American Rolling Mill Co with the skill, intelligence and fidelity associated with its products, and, hence can be depended upon to possess in the highest degree the merit claimed for it. It has behind it the guarantee of that company concerning the purity of the iron and the accuracy and thoroughness with which each step in its manufacture has been conducted

Terne Plate Roofing

Armco Old Style Terne plate, with its Armco Iron base, is made by the Morewood hand dipped, old style, pure palm oil process. No acids are used The coating is pure lead and tin—two almost indestructible metals.

There are seven operations. No higher grade metal roofing is made in the whole world. Each sheet is stamped Armco

How to Get ARMCO Iron

Armco—American Ingot Iron is sold through distributors of sheet metal It is specified by architects and engineers, and is used for making sheet metal products by many manufacturers. You can buy finished products of Armco Iron from hardware dealers, tinners and sheet metal workers. If you have any difficulty getting Armco Iron write us for names of dealers and manufacturers who use Armco. For example, the Page Woven Wire Fence Company use Armco Iron

Write for Free Book "Defeating Rust"

This book, "Defeating Rust," contains *more real information* about sheet metal than ever before has been put between two covers. It tells the complete story of pure iron—Armco Iron It gives processes by which Armco Iron is produced It shows how Armco Iron compares with other sheet metals in analysis, in tests, in actual use. This book gives the experiences of manufacturers in regard to welding, stamping, forming, enameling and polishing Armco Iron. It tells why stoves and refrigerators made of Armco Iron last longer

Our Service Department will advise you regarding the use of Armco Iron Our staff of metallurgists, chemists and practical field men is at your service



48-page book fully illustrated

Please Mail This Coupon

The American Rolling Mill Co.
Box 508, Middletown, Ohio

Tell me why ARMCO IRON is best for.

CHECK ITEMS

__ Roofing	__ Stoves and Furnaces
__ Culverts	__ Enamel Ware
__ Refrigerators	__ Water Tanks
__ Smoke Stacks	__ Railroad Cars
__ Motor Boats	__ Advertising Signs
__ Galvanized Pails	__ Woven Wire Fencing
__ Terne Plate	__ Flumes
__ Window Frames	__ Metal Lath

Name.....

Address.....

THE AMERICAN ROLLING MILL CO., Middletown, Ohio

Licensed Manufacturers under Patents granted International Metal Products Company

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CHICAGO: 1206 Peoples Gas Building PITTSBURGH: 1832 Oliver Building DETROIT: 901 Ford Building
NEW YORK: 261 Hudson Terminal Building ST. LOUIS: 814 New Bank of Commerce Building
CINCINNATI: 2161 Union Central Building CLEVELAND: 965 Rockefeller Building

"It's the splendid new 20 Gauge Marlin"

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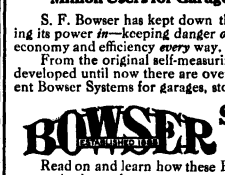
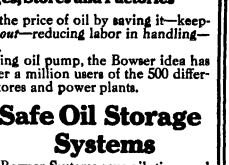
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believe by a critical press that Great Britain is hopelessly behind the Continent in aeronautics. That this is true enough so far as the number of pilots and machines is concerned cannot be denied, but it is equally true that the quality of the material at the disposal of the government is good. Col. Seely, who is probably the leading authority on flying machines in the British army, has stated that the Royal Aircraft Factory's machines are the best in the world for military purposes. No doubt he overstated his case; but in general design and workmanship the British machines are fully equal to those of France and Germany.

As in the case of the other Powers, it is impossible to estimate with any degree of accuracy the aeroplane strength of Great Britain. In naval and military periodicals the aeroplane strength of England is usually placed at about 250. Col. Seely's programme for 1913 called for a peace establishment of 127 machines, 154 officers, and 917 non-commissioned officers and men, with a reserve of 162 flyers for six months wastage in the field. The programme was to be carried out by the end of 1913—a manifest impossibility in view of the limited number of shops and mechanics. Assuming that it has been carried out this year, and that privately owned machines will be impressed into service, Great Britain ought to have not very much less than the 250 machines which it is commonly reputed as possessing.

In dirigibles, Great Britain is badly off. The catastrophe that befell the "Mayfly," Great Britain's first and only experiment in building and running a huge rigid dirigible, is responsible for a dirigible fleet which in numbers makes a poor showing in comparison with the splendid fleets of France and Germany. Germany lost Zeppelin after Zeppelin, but built new vessels, bigger, better, and faster than those which had been destroyed. The British government, on the other hand, became so discouraged after the "Mayfly" accident that it pinned its faith to the non-rigid vessels, and not many of these. All told, England can actually count on seven dirigibles. The non-rigids which took part in the last maneuvers were the "Delta," built in 1912, and the "Astra-Torres" and "Parseval," built in 1913. These vessels are slow, as speeds in the air go, for they are credited with less than 45 miles an hour. They proved quite useless in the high winds which marked the last British Army Exercises, and were out-maneuvered easily by swifter aeroplanes. England has building, however, a huge airship at the Vickers plant, which will have a speed of 50 miles an hour, and in addition five non-rigid airships with speeds of 46 to 47 miles an hour. It is not known how far advanced these vessels are. If her programme could be carried out, by the end of the year Great Britain would have *fifteen* dirigibles.

Belgium and the Air.

Belgium is credited with the possession of one non-rigid dirigible ("La Belgique III") built in 1910. This is a very small vessel of 200 horse-power with a speed of about 45 miles an hour. The craft is really built up out of the ruins of the "La Belgique I," which was all but destroyed in making a landing on April 28th, 1910.

It is known that Belgium has some aeroplanes, but how many nobody knows. No doubt the machines are of French manufacture, and manned chiefly by French pilots.

Enigmatic Russia.

Nothing very definite is known about the dirigible strength of Russia. She is known to have two airships ordered in France, whose construction can hardly be very far advanced, and three others in actual course of construction. So far as the records show there is only one Russian dirigible which seems to be in actual commission, and that is the "Astra XIII," which was built in 1913—a 35-mile an hour non-rigid driven by 400 horse-power engines. But it is reported that she can actually count on three ships.

Of the aeroplane strength of Russia nothing is known beyond the fact that Sirkosky has built two very large ma-

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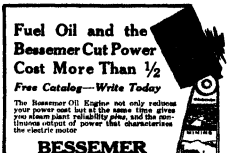
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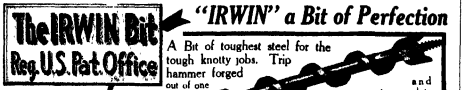


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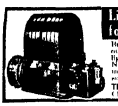
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chines, which are much too slow for effective military use. She is credited with 500 aeroplanes in aeronautical annuals, but that seems highly imaginative.

Austria-Hungary's Aerial Strength.

Austria-Hungary has three army airships, two of which are non-rigids, and the third a semi-rigid built in Austria from Lebaudy-Juillot plans. The speeds run from 25 to 35 miles an hour. Six Zeppelins are projected, but it is doubtful if these can ever be completed for financial reasons. There are in actual commission two passenger airships which might be available for military purposes. Of the Austrian strength in aeroplanes nothing at all is known.

A Comparison of Naval Strength

(Concluded from page 174.)

a vast preponderance in torpedo-boat destroyers, the Triple Entente having 342 as against 148 possessed by the Dual Alliance. In torpedo boats the figures are 198 as against 39, and of submarines, the Triple Entente possesses 160 as against 27 owned by the Dual Alliance.

The total tonnage of the three fleets of the Triple Entente is 3,168,051 as against 1,150,213 possessed by Germany and Austria.

Should the great war prove to be long drawn out, the question of the relative shipbuilding and repairing facilities of the contending nations would become of prime importance Here the Triple Entente will have a decided advantage, because of their command of the sea and the absolute security of their shipbuilding yards and ordnance factories against attack; for it is not likely that the German invasion of France will reach any of her naval yards In the earliest stages of the war, German shipbuilding, especially in the direction of completing the ships which are now under construction, will be carried on with feverish activity. Later, if the Russian invasion continues to advance along the shores of the Baltic, or in the unlikely event of a successful reduction of the German naval bases from the sea, the availability of the German yards for completing new ships, and making good the wastage of battle, might be seriously curtailed

The Mistress of the Seas

(Concluded from page 178.)

one of the fastest class of destroyers, which showed on trial a speed of 34.5 knots The British have shown a tendency in later vessels to increase the size and ocean-going qualities, keeping the speed down to 29 or 30 knots

Particularly strong is the British navy in submarines. Slow at first to take up the new type of craft, when she was once assured of its value England entered into the work of developing and building submarines with great activity. The one herewith illustrated is of 800 tons displacement and 16 knots surface speed Vessels of this class are now being built which are to be capable of making 21 knots on the surface and a proportionately high speed when submerged.

Russian Navy in the Baltic

(Concluded from page 181.)

Of battleships, Russia has in consolidation in the Baltic only four pre-dreadnoughts. The two most modern of these are the "Imperator Pavel" and the "Andrei Pervosvannii," which were laid down in 1903 and completed in 1911. They are improved "Slavas," and they embody improvements suggested by the Japanese war. They are of 17,400 tons, and 18 knots speed The belt is 8½ inches, the upper belt 5 inches, and the rapid-fire battery protection is 3 inches thick. The armament consists of four 12-inch and no less than fourteen 8-inch and twelve 4 7-inch in the intermediate battery. The other two battleships are the "Slava" and "Tsarevitch," of 13,500 tons and 18 knots, protected by a 7¾—10-inch belt, and carrying four 12's and twelve 6's in turrets.

The most important of the armored cruisers is the "Rurik," of 15,000 tons and 21.5 knots, with a 6-inch belt, carrying a



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powerful armament of four 10's and eight 8's in the turrets, and twenty 4.7's behind 3-inch armor. The armored vessels of the "Admiral Makaroff" class are of 7,775 tons and 22.5 knots, with 7-inch side armor. They mount two 8's in turrets and eight 6's on the broadside. The "Gromobol," 13,200 tons, and the "Rossiya," 12,500 tons, carry, respectively, a 6-inch and a 10-inch belt. Their speed is 20 knots, and each mounts four 8-inch and twenty-two 6-inch guns. They were completed in 1901 and 1908.

Of protected cruisers, Russia has in the Baltic two fast scouts, just completed, the "Moravlev" and the "Nevskoy," of 4,500 tons and 27.5 knots, mounting eight 5-inch guns, and six older vessels, the "Juntchug," 3,050 tons and 24 knots; "Askold," 6,500 tons, 23 knots; "Bogatyr" and "Oleg," 6,650 tons, 23 knots, and "Diana" and "Aurora," 7,600 tons, 20 knots per hour.

The most valuable asset of Russia in the Baltic is her torpedo fleet, consisting of 80 destroyers and 13 submarines. The earlier destroyers, built between 1895 and 1905, average about 370 tons displacement, and their speed is from 26 to 28 knots. The later boats, twenty in all, are from 500 to 650 tons, with speeds of 26 and 27 knots. A notable destroyer in size and speed is the "Novik," of 1,200 tons and 36 knots speed. Thirty-six new boats of this "Novik" class are being built and many of them will soon be available in the war. The Baltic fleet also includes 16 torpedo boats of from 120 to 200 tons, and from 21 to 30 knots speed.

The submarines built between 1904 and 1909 vary from 150 to 500 tons in displacement, with surface speed of from 9½ to 15 knots. A dozen new boats are being built, of large size and high speed.

Germany's Bid for Naval Supremacy

(Concluded from page 184.)

side. Their speed is about 21 knots. The "Prinz Adalbert" and "Friedrich Karl," completed in 1903, are generally similar to the "Roon" class. The "Prinz Heinrich," of 8,900 tons, completed in 1900, carries two 9.4-inch guns in two turrets, forward and aft, and ten 6-inch on the broadside. Her speed is 20 knots, and she is protected with 4 inches of armor. The "Fürst Bismarck," built in 1897, of 10,700 tons, mounts four 9.4-inch guns in two turrets, forward and aft, and twelve 6-inch on the broadside.

The German fleet is strong in protected cruisers and fast scouts of which she possesses 41. The five ships of the "Freya" class, 19 knots speed, carry two 8.2-inch and six 6-inch guns. They were built in 1898, and reconstructed in 1907.

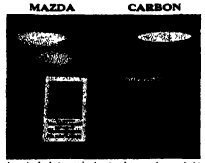
The finest protected cruisers of the German navy are the five scout cruisers of the "Karlsruhe," the "Breslau," the "Kolberg," the "Dresden," and the "Stettin" classes. Much has been heard of these ships during the present war. They are so fast, many of them having speeds of from 26 to 28 knots, that the fast protected and armored cruisers of the British and French are unable to capture them, and they can overtake the speediest of the merchant ships afloat.

At the opening of the war Germany had 130 destroyers in commission, and no doubt she is rushing work with feverish haste upon those which are now building. Her destroyers, especially those built since 1905, are fine vessels of their type, varying from 525 to 820 tons in displacement, and having speeds of from 30 to 32.5 knots. They are excellent sea boats, and Germany has paid particular attention to this arm of her torpedo service. It is probable that before the war is ended these craft will have crippled or sunk many a first-class ship connected with the navies of the enemy.

The Germans were slow to take up the submarine; but as soon as this type of craft had proved its great offensive and defensive value, the navy paid great attention to its development. At the opening of the war 21 submarines were in commission. Their submerged displacement varies from 250 to 800 tons.

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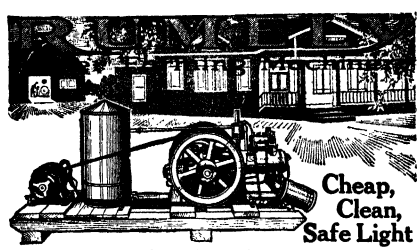
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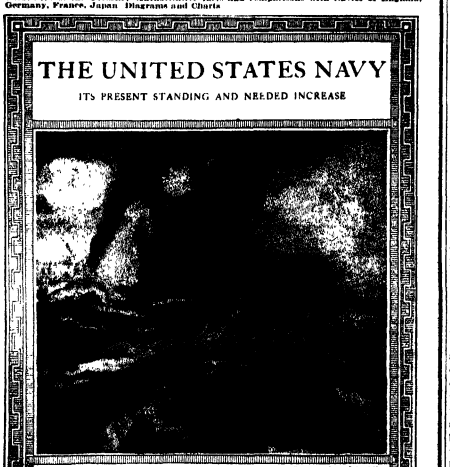
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Rifle Fire and Aircraft

THE experiment of shooting with a rifle at an army target from an aeroplane has been tried by Edward C. Crossman, who tells his story in the *United Service Magazine*. The targets used were six feet square, with a 20-inch bull's eye, and constitute the mark used at 500 and 600 yards in army slow fire practice, so the task set for the aerial marksman was decidedly severe, especially as his work had to be done under particularly trying conditions.

"In front of me stretched the hood, covering, like the hood of a motorcar, the engine of the tractor biplane," says Mr. Crossman. "My left elbow rested comfortably on the top of the hood, the muzzle of the light sporting Springfield protruded beyond a pair of crossed stays running from upper to lower plane.

"Just under my left elbow, as I sat half faced to the right, were the four black pipes of the exhaust, innocent of muffler and but a few feet from my ears.

"The muzzle of the rifle did not clear the forward part of the hood, and I was implored by Earl Dougherty, the aviator, and by Gage, the owner of the great tractor, not to shoot off either the crossed stays or the top of the radiator just below my rifle. They made me nervous, there were too many things to consider. Just above the breech of the rifle ran the flexible tube of the gas line from the tank just over my head. I was beseeched not to let the rifle recoil into this tube and break it, lest the engine stop and we be forced to do some unplanned volplaning with the alighting not of the best."

With the engine chattering under his elbow like a rapid fire gun the machine swept around the field, and the targets were discovered as a far off postage stamp affair against brown ploughed earth, but too distant for the experiment, so the craft was turned, and, pitching and vibrating unsteadily in the "rough air," a long circuit was made to get within range; and it became evident that it would be a case of snap shooting, and some luck to make a hit under the conditions.

"Heeling over before the heavy breeze under our planes," Mr. Crossman continues, "we turned once more, and this time pointed our bows for the tiny white square a half-mile away. We dropped a little, but it was rougher as we went down. Apparently we were not traveling fast, but the target came to meet us with most amazing rapidity.

"At 400 yards, with the muzzle of the rifle travelling in quick vibrations far larger than the target, I caught the jitting gold bead on the paper, and squeezed the trigger.

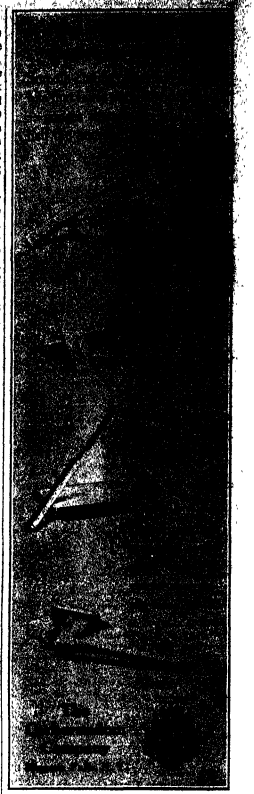
"I had expected a surprise party of some sort, but not that sort. The light rifle, fired with the heavy army cartridge, tapped me lightly on the shoulder, but there was not a whisper to announce that the shot had gone, not the faintest sound of the usual Springfield bellow. The roar of the engine and the blades close to me were terrific, but that they could utterly drown the sound of the rifle seemed impossible.

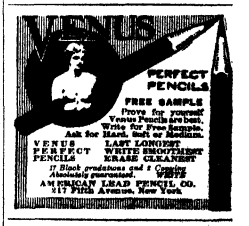
"Seemingly behind the paper there spouted from the soft dry earth a brown column of dust that put an end to any doubt as to whether the rifle had been fired.

"Another shot kicked up a second plume at the range of 200 yards, then we swooped down for the target like a hawk on its quarry. The familiar white paper with its lines and its jet black center came up to meet me at horrifying speed. One more shot tapped my shoulder, and spouted dust behind the paper; then we swept off into the air once more and sought our old height.

"Apparently the last two shots had hit, the dust seemed to be directly behind it, although I could plainly see it from where I sat. We swept around the field in our mile-long circle, while I noted my assistant making frantic signals with his disks that my shots were going high."

A second circuit produced the same results, while in the third attempt the craft was headed point blank for the target,





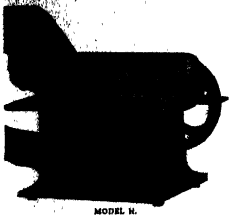


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but the marksman, waiting for the last second, pulled the trigger too late, just as the ship shot suddenly upward, sending the last shot higher than any of its predecessors.

The summing up of the trial is instructive, although disappointing for those enthusiasts who expect such universal application of the flying machine.

"Needless to say, the man on the ground with his own rifle is far more formidable to the man in the ship than the airman can ever hope to be to the humble plodder below him. Hitting the ship at a range when fire from the ship becomes remotely effective is an easy task for any skilled shot; and with two passengers, stays, gasoline tank and engine as the vital points of the 'bird,' the pilot will do well not to cross rifles with anybody on the solid ground.

"With a mark 25 feet square, and with circumstances such that the said mark contained no riflemen to reply, the airman might approach the earth and open fire with his own rifle.

"Aside from such combination of fortunate circumstances, the airman will do well to keep out of reach of the humble infantryman below, even though there be but one of the infantrymen, and he be guarding something most desirable to the fliers above him."

The Scientific Side of Baseball

By Arthur Macdonald

MUCH of the matter presented in this article is based upon opinions of the best players in the history of the game, and it is usually the opinion of the player best qualified by his skill and success in the play in question. This is the most that can be done in any scientific study, where a sufficient number of facts have not been recorded. If, as I shall suggest later, everything that takes place in the game were recorded, it would not be necessary to depend so much upon opinion. A rigid scientific study of baseball is, therefore, not as yet possible.

Fielding.—The great thing in fielding is to know where to throw the ball after you have caught it, and to be careful how you throw, for more games are lost by wild throws than any other kind of error. If not possible to keep a man from running to home base, you can throw it as if you meant to send it home, but really for the pitcher to put men out on bases.

Fumbling the Ball.—If you fumble a ball so that it is too late to throw to first base, nevertheless make a motion as if you intended to do it, but throw to another base, to retire some runner who thought you were going to throw to first. On the other hand, a little fumbling may be purposely done, to coax the runner to make the next base and be thrown out.

To Put Out Men Overrunning Bases.—When a runner is on first and an infielder throws the batter out, throw the ball to second, as the man running from first often overruns the base. For the same reason, if a man is on first and a ball is batted to left field for a hit, let the fielder shoot the ball to second, while pretending he is going to throw to third, and he will often put the man out on second.

Difficulties of Right Fielders.—The right fielder has special difficulties, because balls hit in that direction curve sharply in the air and compel him to extend his territory far over the line. These curves from right-hand batters are especially troublesome. The left fielder has the same difficulty, but in a less degree. The right fielder is called "Old Probabilities." It is the opinion of many that right field should be played in close, except in the case of certain batters whose habits are known. A few fielders claim that they can tell by the sound of the bat into which field the ball is coming. I have found by listening very carefully that this difference in sound is a fact.

When a right-handed pitcher delivers a low curved ball to a left-handed batter, the probabilities are the ball will be hit to right field. If the first and second basemen and right fielder know this they have a special tip. If a high ball is to be delivered to a left-handed batter, the first and second basemen upon getting the sig-





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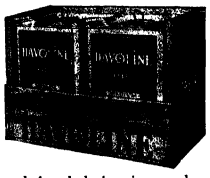
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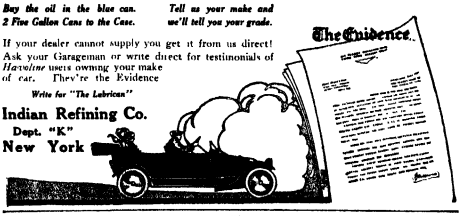
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nal should move up toward second. Also a low curve for a right-hand batter will probably go to left field. A fast, straight ball is liable to be hit to right field.

Other Points on Fielding.—If three men are on bases with one out, do not play in so close. If the ball be hit to shortstop or third baseman quickly, do not throw home, but to second to make a double play and end the inning.

When an outcurve is to be pitched the third baseman and shortstop should move toward second base.

To entrap a grounder, get in front of the ball and keep the hands as near the body and feet as possible, and if you fumble you generally stop the ball at least. If you reach forward to meet the ball it is apt to hit your arms and bound away.

It might be noted in passing that sometimes an outfielder misses a ball, because he does not keep his eye constantly on the batter. He has more excuse for this than the infielder because, especially in a "pitcher's game," it requires much patience to keep up a constant watch on the batter when very few, and sometimes no balls come to the fielder. This condition might be improved by better batting, and if the fielding is also good, the game will be thrilling for the spectators.

Some of the best fielders do not necessarily have the highest averages, for they will attempt to reach flies that the ordinary fielder never could or seldom would try to get. The reason averages do not tell the whole truth is that the official score does not record these omissions of the mediocre player.

Pitchers.—Modern pitchers are not ball players in the ordinary sense. For state the numerous qualifications of a ball player, and the pitcher will fulfil few of them. The pitcher, for instance, is rarely a good batter or base runner.

Pitching has been so highly developed as to become the most specialised feature of the game. The pitcher must study each batter and deliver him the kind of ball he does not like. The majority of games are won or lost by pitchers blundering at the crucial moment

One pitcher had a legal balk motion. He acquired this by pitching at a mark on a fence for first base while looking at another mark which stood for the home plate. By faithful practice he could suddenly throw to first base and put runners out while looking straight at the batter.

Pitchers sometimes complain of their support, but they would receive better support if they would take the trouble always to signal, or have others signal the basemen and fielders as to what kind of ball they purpose to deliver next.

Sometimes a pitcher, who is called a "waster," never puts a ball over the plate until compelled to do so, but throws it high, low inside or outside to make the batter hit bad balls.

In defense, pitching is rated as high as 80 and as low as 20 per cent of the game.

A Spit-Ball Pitcher.—A star spit-ball pitcher follows two of his spit-balls (which drop sharply when crossing the plate) by a straight fast one which invariably jumps when it reaches the batter. This jump, which is about three or four inches, looks much greater to the batter, who has just seen the spit-ball drop on him, so that expecting another spit-ball, the batter who has just swung over one is very liable to swing as far under the straight ball A spit-ball is difficult for catchers to manage, especially when men are on bases.

Spit-ball seems to have been dropped by some for esthetical and other reasons.—Abstracted from *American Physical Education Review.*

An Electrical Signal Invented by Fessenden.—Reginald A. Fessenden, of Brant Rock, Mass., has secured a patent, No. 1,101,914, providing an apparatus for signaling by electro-magnetic waves in which a radiating conductor close to the earth, and grounded at both ends, lies in the direction of propagation of the radiated waves. Another patent, No. 1,101,915, to the same inventor provides an addition for dissipating any portion of the electrical charge not utilized in producing radiation, by means of low resistance conductors.

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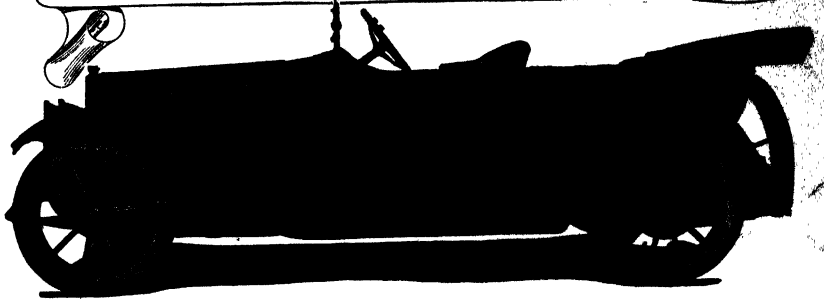
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A "Light Six" That's Different

—that has been carefully, painstakingly designed on sound engineering principles.

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—that will throttle down to one mile an hour on high gear.

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—that will travel from 22 to 25 miles on one gallon of gasoline.

—that has been accurately built and expensively finished.

—that will maintain the reputation of its predecessors. Such is

THE HAYNES

America's Greatest "Light Six"

Specifications in Brief

Unit power plant, 3-point suspension, 6-cylinder enbloc motor, actually developing 55 brake horsepower 121-inch wheelbase
Left-hand drive, center control
Weight, completely equipped, 2950 lbs., giving more than one horsepower to every 55 lbs. of weight
Leece-Neville separate unit starting and lighting system. Ignition from storage battery through Remy distributor and coil
Economical Rayfield carburetor

Vacuum gasoline system with gas tank at rear of chassis. Splash and force feed lubrication
Forced water circulation
Clutch, three-plate dry disc type lined with Raybestos
Transmission, selective sliding gear type, three speeds forward, one reverse
Haynes *full floating* rear axle
Exclusive arch frame construction
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Clear afid rain-vision ventilating windshield
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The Haynes Automobile Company
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Name _____

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In addition we build Model 31, "Big Six" with 65 brake horsepower and 130-inch wheelbase—$2250; Model 32 Haynes "Four" with 48 brake horsepower and 118-inch wheelbase—$1660.

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The Haynes Automobile Company
46 South Main Street Kokomo, Indiana

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Future Construction—Our Present Delivery

Doors 22 inches wide. Deep, luxurious upholstering—hand-buffed leather. Six comfortable seats.

Weight 3250 pounds—carried low. This with even distribution of weight insures the greatest tire economy and easiest riding qualities.

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Tank in rear absolutely accessible avoiding danger of spilling gasoline in front of car. Underslung rear springs 56 inches long Full floating rear axle

Left hand drive, rain vision windshield Electric starter, electric lights, electric horn. Spark and throttle on steering wheel. Foot accelerator

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Wheel base 135 inches. Short turning radius. Speed without shift 2 to 60 miles per hour Demountable rims (one extra) Road clearance 11 inches

While other manufacturers are still seeking ideas from Europe's 1915 automobiles we have already anticipated them. We offer for immediate delivery a replica of Europe's most elegant type of automobile. It is equipped with a wonderful motor; the same type of motor which won the first four prizes in the Indianapolis races this year. Rene Petard, the famous European engineer, whose name recalls his former association with the Italia, Fiat, Unic, and Daracq cars, has designed a small bore, long stroke, high speed motor, the

Lewis Year-In-Advance Six

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Compare it with every car made; place it beside Europe's and America's finest cars—even those costing twice as much—and you will still be proud to own a Lewis Six.

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A car having the appearance of a $3,000 one for $1,600.

L. P. C. Motor Co. Builders of the Lewis Six 56 Lewis Street Racine, Wis.

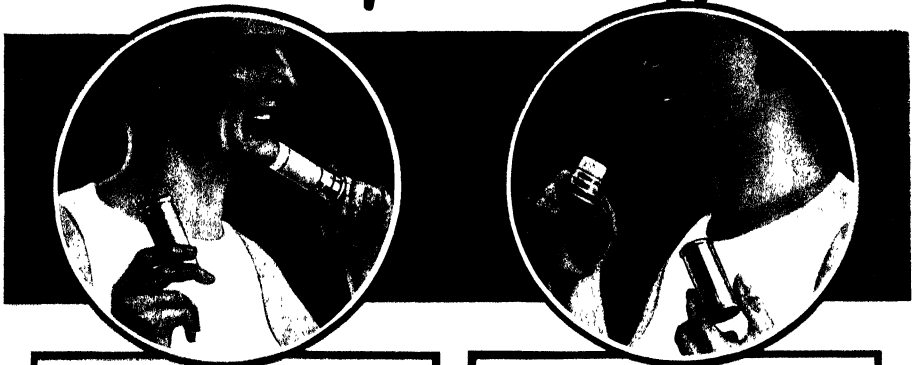
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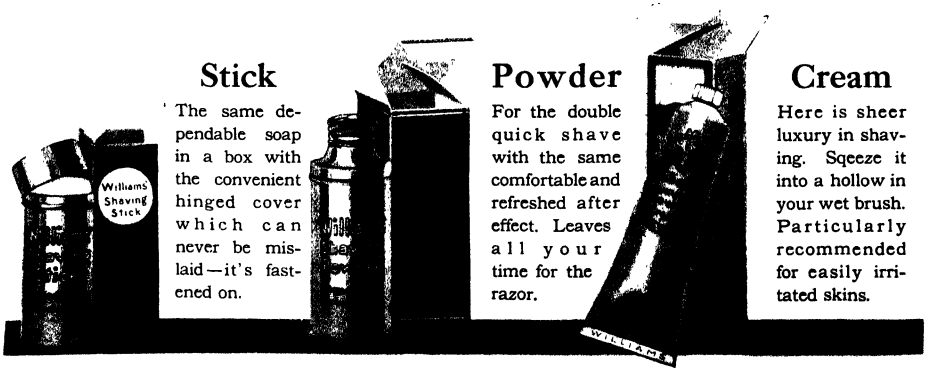
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Powder

For the double quick shave with the same comfortable and refreshed after effect. Leaves all your time for the razor.

Cream

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16 NOV. 1914

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The Naval Battle in the North Sea
New Things in Science and Invention

Vol. CXI. No. 11
September 12, 1914

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

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The First Month of the War

At the opening of the war it was well understood (for a distinguished German general had written it all out in a book) that the grand strategy of Germany would be to concentrate the flower of her army against the French, overwhelm and scatter them in the first two or three weeks of the war, invest Paris, and then turn against Russia in an equally swift and crushing onslaught. At the present writing, with the war over a month in progress, nothing of the kind has happened. The French and British armies are intact and everywhere in touch; they have fallen back upon the line of forts and strongly intrenched positions, provided years ago by France to meet the inevitable German attack, and for the past three weeks they have not only presented an impregnable wall of defense, through which the Germans have failed to break; but in the rearward movement to their present position, they have fought a series of defensive battles in selected and entrenched positions, which, on the theory that the losses are three to one against the attacking force, must have cost the German army already not less than 200,000 men in killed, wounded, and otherwise disabled.

The Germans, it is true, have forced back the left wing of the allies; but they have done this at an enormous military and *moral* cost. The military cost has been due to the fact that here they found themselves opposed by 100,000 professional soldiers, men who, during their seven years of service with the colors, had been so thoroughly drilled in practice at the rifle butts, that they were crack marksmen, which fact, coupled with the traditional steadiness of British troops under fire, enabled them, against odds of between two and three to one, to fight a series of defensive actions in selected positions, from which they did frightful execution upon the heavily-massed columns of the Germans.

To the enormous losses in men entailed in this flanking movement, is to be added the even more serious moral loss which Germany has incurred in bartering her national sense of honor in exchange for the opportunity presented by the undefended French-Belgian line to rush across the French border in overwhelming numbers. France and Germany had both guaranteed the neutrality of Belgium. That France intended to stand by her pledge is abundantly proved by the fact that, when Germany made her rush through Belgium, France, even in spite of the delay afforded by the staunch Belgian resistance, had no time to concentrate her troops in Northeastern France in sufficient numbers to check the German onslaught. Nothing that Count Bernstorff or any other apologist of the German breach of good faith may say, can make the American people think that Germany believed France was intending to do that which she herself has done. The facts are all absolutely and conclusively against such a supposition. So little preparation had France made to resist a German invasion through Belgium, that, had it not been for the totally unexpected interposition of England on behalf of Belgium, and the magnificent fight against overwhelming odds put up by the small Belgian army, Germany to-day would be inside the very gates of Paris.

The French line of defense stretched from Belfort to the southern limits of the Belgian frontier. North of that she believed that her defense consisted of a "sheet of paper" with the solemn attest thereon of herself and her great German neighbor. The loss to France and Belgium of the fair lands that are now being overrun with fire and sword by Germany, is, after all, trivial compared with the enormous loss of moral prestige suffered by the ruthless invader—a loss which no carefully worded sophistication of the diplomat or the historian of the future can ever redeem.

The position of the allies to-day is strategically and tactically very strong. Based on a line of fortifications reaching from Belfort on the south almost to Paris itself; with strong reserves in the rear and ample railroad communications serving the allied army upon interior lines; with the spirit of the troops absolutely unbroken; and with the choice of several French seaports through which Great Britain can pour in her reserves, France and her allies find themselves facing foes that are feeling the enormous strain of weeks of attack on entrenched positions.

The probability is that the much-talked-of complete investment of Paris will never take place; and if not, how and where is Germany to deliver that crushing blow which is to put France under her heel, and release that half million of men which Germany must send to meet the victorious Russian advance, and to stiffen her sorely-worsted Austrian ally?

It is surprising that none of the military critics have drawn attention to the fact, altogether unprecedented in great wars, that there has been no breaking through and enveloping of any section on either side, German or French, of this great battle line, two hundred and forty miles long, in which, surely, there must be some two-and-one-half millions of men engaged. To our thinking, this fact is explained by the absence from the field of operation of *that secrecy of movement* which formerly rendered it possible to concentrate overwhelming strength against one or more portions of the enemy's lines, and break through and envelop and capture a whole army at a time. We all remember what happened at Metz and Sedan. Such catastrophes are not happening, and are not likely to happen, to-day.

Why?

Unquestionably the change has been brought about by the wonderfully efficient aeroplane scouting, of which so much is being done in the present war. The turning movement of the German right wing is not a case in point; for the success of that movement was due to the initial advantage gained by the violation of a treaty. It begins to look as though the grand strategy of the allies is to accept the initial advantage thus stolen by Germany and encourage the foe to break through at enormous sacrifice of men to Paris, the allies meanwhile swinging into position with their left wing pivoted upon the enormous defenses of that city and their right upon the equally strong defenses of Belfort.

Penalizing Invention

THE American patent system received a serious blow when the Senate of the United States, on August 20th, amended Section 4 of the Clayton Anti-trust Bill by forbidding any contract relating to patented articles that contains any provision "the effect of which" may be either to require the purchaser or lessee or licensee to acquire any article "not protected by the patent" or to restrict him from using any article. Parties to such contracts are made liable to a fine of $5,000 and imprisonment for one year.

Only patented articles, and manufacturers, dealers, and purchasers of patented articles, fall within this prohibition. For the first time in the history of invention, therefore, the possession of a patent has been made an essential element of crime. The pretext upon which this proposal is made is that legislation is needed in order to prevent restraints of trade under the cloak of patents.

No such legislation, in fact, is needed. In the Bath Tub Case (United States v. Standard Sanitary Manufacturing Company, 226 U. S. 20, decided in 1912), the Supreme Court of the United States held that patents afford no shelter to restraints of trade against the Sherman Law. The Supreme Court said (page 49):

"The added element of the patent in the case at bar cannot confer immunity from a like condemnation, for the reasons we have stated. . . . *Rights conferred by patents are indeed very definite and extensive, but they do not give any more than other rights, an universal license against positive prohibitions. The Sherman Law is a limitation of rights, rights which may be pushed to evil consequences and therefore restrained.* . . . The comprehensive and thorough character of the law is demonstrated and its sufficiency to prevent evasions of its policy by resort to any disguise or subterfuge of form or the escape of any indirection."

Some of the unexpected consequences of the amendment are most disastrous and far

Agreements between manufacturers, [illegible] tomers, by which manufacturers and [illegible] and customers obtain complicated and [illegible] mechanisms, on condition that they use [illegible] supplies specially prepared for them, or [illegible] with machines especially adapted to them, are often absolutely necessary. Every possible abuse of this entirely legitimate [illegible] the Supreme Court shows, is already [illegible] Sherman Law.

The amendment adopted by the Senate, however, [illegible] laws every such agreement. An independent manufacturer, seeking to gain a foothold in the face of competition from the old established trade, frequently finds it up a good will for his business by advertising and selling all his various products under the same brand. In order to push his entire "family of specialties" against the old established brands, he selects local dealers who undertake either to handle his products exclusively, or, as more frequently is the case, to handle a specified variety and quantity of his products for a specified period in consideration of a special discount.

In many lines of business, this arrangement is usual and necessary. Every possible abuse of this arrangement is already forbidden by the Sherman Law. This seems to have been recognized as regards unpatented articles, for as to them the provisions adopted by the Senate have no application. If, however, any patented article happens to be included under such an arrangement, with the result that the agreement requires the dealer to buy both a patented article and also another article not covered by that patent, then the manufacturer and the dealer both become liable to a fine of $5,000 and to a year's imprisonment.

These penalties become operative regardless of whether the parties to the agreement have any knowledge of the fact that any article within the agreement is covered by the patent. Agreements drawn without any reference to patents, agreements drawn in ignorance of the existence of patents, and agreements which from time immemorial have been normal and customary, are all made criminal if they happen to include any patented article; while precisely similar contracts, relating to unpatented articles, may continue to be made with absolute impunity.

This manifestly unjust and discriminatory piece of legislation passed the Senate on September 3rd, 1914.

"Chiropractic"

THE *Health Bulletin*, published by the North Carolina State Board of Health, has rendered admirable service by its trenchant articles anent various forms of medical quackery. Its July number discusses "chiropractic," which is described as "a freak offshoot from osteopathy." "Chiropractors" assert that disease is caused by pressure on the spinal nerves, and can be eradicated by "adjusting" the vertebræ.

It appears that chiropractic is taught—at least in North Carolina—on the mail order plan. The chiropractic "college" will matriculate anybody who can pay the fee, regardless of previous education (or, rather, lack of it), and turns out a full-fledged chiropractor at the end of a few weeks' instruction by correspondence.

Chiropractic, whatever its shortcomings, is abreast of the times in its methods of advertising. The *Bulletin* describes a photoplay entitled "The Pale of Prejudice," now going the rounds of various moving-picture houses. "It shows a young physician with a most wonderfully equipped office, piled high with skeletons, chemical retorts, etc., with all the essentials necessary not only for studying anatomy, but for making *steel analyses*. He is called suddenly to see a young woman who is ill. He rolls up his sleeves, pours half the contents of an 8-ounce bottle down the young woman, who immediately dies." This discouraging experience naturally leads him to become a chiropractor, whereupon the State Board of Health takes away his license to practise medicine, and his engagement to the Governor's daughter is broken off. The next scene shows the young lady ill, and the whole State Board in consultation declaring that she has only an hour to live. The patient plucks a rose from her kimono, which she gives to her mother, who carries it to the ex-lover and ex-physician, whose chiropractic consulting-room is now seen to be innocent of skeletons and metallurgical apparatus. The young man rushes to his sweetheart's bedside, drives the medical fogies away with a six-shooter, and cures the expiring maiden in a jiffy, by means of three "adjustments" of her spine. "The dust scene," says the *Bulletin*, "shows this particular branch of quackery licensed by the Legislature, the bill signed by the Governor. On the back of the [illegible] where this film is shown is the name of every chiropractor in town."

Engineering

Vessels in the Larger Vessel?—Although the "Aquitania" is 12½ feet longer than the "Olympic" and five feet wider, the latter is nearly ten feet deeper, and has a net tonnage of 22,350 and a gross tonnage of 46,359, as against 21,892 and 45,647 tons for the "Aquitania."

A Useful Application for Oxygen.—It has been found that if oxygen is added so as to bring the percentage from 21 to 30 per cent as at present in the blast of a blast furnace, there is a saving of 50 to 60 kilogrammes in the amount of coke required to smelt a ton of iron, and the iron produced is of a superior quality.

Electro Magnets on Steam Cranes.—An electro lifting magnet would frequently prove very serviceable for use with railroad wrecking cranes of the usual steam operated variety, but the necessary electric current is lacking. In such cases it has been suggested that a small turbo-generator could be easily fitted, and would be a valuable addition to the equipment.

A New Mineral Found in Tasmania.—Many rare minerals exist in Tasmania, and lately a new addition has been made to the list by the discovery of molybdenite, which is used in the manufacture of molybdenum steel, to which it gives special hardness and toughness. As the present price of this mineral is about $2,500 a ton, the discovery should prove of considerable value.

Dies with Screw Holes.—In hardening dies and punches, in which there are screw and dowel pin holes, it is common practice to plug the holes with asbestos, of the wick or granulated form, to prevent injury to the screw threads or enlargement of the dowel holes by scaling. When this is done, trouble is often experienced in cleaning out the holes, as the asbestos sometimes becomes baked on. To avoid this, the asbestos should be mixed with graphite and oil, as holes plugged with this mixture can be readily cleaned and will be found entirely free from scale and the like.

A Monster Aqueduct.—The aqueduct conducting the waters of the Owens River to Los Angeles is said to be the largest in the world. It is designed to deliver a minimum of 258,000,000 gallons of water daily into the San Fernando reservoir, 25 miles northwest of the city. No pumping plant is required, as the source of supply is several hundred feet above the city. The water will furnish a great amount of power—70,000 horse-power is anticipated—for electric lightning and other purposes. The total cost of the waterworks will be $25,000,000, and the installation of the power plant will be approximately $5,000,000 more.

A Waterproof Cement.—It is said that the United States army engineers have long used the following mixture for water-proofing cement: One part of cement, two parts of sand, three quarters of a pound of dry powdered alum to each cubic foot of sand. These are mixed and dried, and to them is added water in which has been dissolved three quarters of a pound of soap to each gallon. This, it is said, is nearly as strong as ordinary cement, and is quite impervious to water, and does not effloresce. For a wash, a mixture of one pound of lye and two pounds of alum in two gallons of water is often used.

A Novel Car Ferry.—An ice-breaking train ferry-boat has recently been built in England for transferring trains across the St. Lawrence River from Quebec to Levis. The tidal variation is 18 feet, and to provide for this the deck of the boat that carries the trains is arranged to be raised or lowered by a series of long screws distributed at intervals on either side, and all operated simultaneously by a special engine. This provides for receiving and transferring trains at fixed level terminals at either landing, the immediate connection between the shore end and the boat track being by a short hinged gangway attached to the boat deck. As the ferry is designed to operate throughout the winter a nickel steel screw propeller is located at the bow to clear ice from the landing stage. When not in use this propeller is permitted to run idly.

At a Meeting of the Institution of Mechanical Engineers, at Paris, recently, the subject of locomotive cab signals was discussed, and the opinion was expressed that such signals should always be of the audible kind, as these would not distract the attention of the engine man from the road in front, and the regular road signals. In support of this suggestion, the evidence of an engine driver at an accident inquiry was quoted as follows: "You must realize that when you are rushing along at 60 or 70 miles an hour you are seldom out of sight of signals, and in the daytime there are always men about the road; and but for the vigilance of drivers I think a number of men would be injured, such as linesmen and others, who are absorbed in their work. A touch on the whistle first announces your approach, and I do think that everything that can be done to illustrate the driver from anything that takes his attention off the road when he is running should be done. The driver should always be able to devote his sole attention to looking out and to the manipulation of his regulators."

Electricity

Electric Locomotives for Mountain Line.—The new electric locomotives now in use on the Usui-Toge mountain railroad in Japan have two driving wheels and a pilot wheel. Inside the body of the locomotive are two electric motors of 400 horse-power, one of which serves to drive the adherence wheels by bar and crank, while the second motor is coupled to a pair of rack wheels for use on the *rack-and-pinion system*. Adherence and rack-rail are thus worked separately. Contact shoes work upon the under side of a third rail, and a trolley is also used in some places. Electric switching couplers for the motor contacts are operated by magnets fed by storage battery current at 80 volts.

Electric Floor Brush.—An improved electric brush for polishing wood floors uses an electric motor at the top and a large round flat brush underneath the motor. To keep the motor from turning about along with the brush, there is used a steadying device in the shape of a pair of square-shaped flat brushes at the sides of the central one. Each square brush is mounted on the end of a shaft projecting from the middle casing and is geared up so that the shaft works in and out as a plunger, so as to produce a to-and-fro movement of the side brushes. This steadies the whole set and at the same time allows of moving the whole very readily over the floor by means of the long handle.

New Diesel Motor for Dynamos.—Numerous attempts have been made to bring out a small oil engine of the Diesel type for use with dynamos, using an engine with spontaneous ignition and combustion at constant pressure, but such an engine-dynamo group of compact shape and small size has not as yet been produced in Europe *hitherto*. Success now follows the designs of one of the large construction works, and the result is a Diesel engine group which ranges from 10 to 200 horse-power With the engine, which has 2 cylinders for the small sizes, is built an air compressor giving a pressure of 60 atmospheres for starting and for oil spray. On the engine is also an oil pump for cylinder supply. The dynamo is built alongside the engine on the same shaft. On the whole, the new Diesel groups will prove economical as well as easily handled.

French Parliament Installations.—The great building that houses the branch of the French Parliament known as Chambre des Deputés, at Paris, contains numerous up-to-date electrical and mechanical appliances The main semi-circular Parliament session hall has no less than 602 seating places for the members of this body. The electric lighting system consists of a ceiling of ground glass, above which are disposed about 800 incandescent lamps in semi-circular rows, with reflectors on each lamp In the basement is a good-sized electric plant containing eight dynamos operated by gas engines running upon coal gas from the city mains Dynamos work upon a large storage battery on the premises, and the electric plant has an output of no less than 2,500 horse-power, this being needed for the main hall and numerous rooms or offices. In the basement is a large electric fan which draws in air so as to send it into the main hall, and in winter this air passes first through a steam radiator device to heat it up. At the top of the hall is a like motor fan for evacuating the air through the roof. Here is also mounted a large water tank containing 20,000 gallons, by which the hall can be flooded in case of fire We should also mention the numerous telephone booths with which the building is provided.

Electric Motors for Pumping Plants.—The use of electric motors for operating pumping plants is on the increase in Europe. Such plants comprise city water works, sewage and drainage plants, and we may consider two general classes of pumps, namely piston and rotary pumps. We have already referred to the use of piston pumps, and now wish to refer to electric drive for rotary pumps. Although the output of the rotary pump is much less than that of the piston pump, the output of the high-speed electric motor which is usually coupled direct on the rotary pump is greater than that of slow-speed motors used with piston pumps However, even with belt drive on piston pumps, the all-around yield is superior in this latter case. But the rotary pump has several advantages which lead to its use in a number of modern water pumping plants Pump and foundations cost but little, and the plant, also, is of small size Upkeep is small, for the bearings are almost always self-oiling. A recent compact group has an electric motor and pump mounted on the same base, and such groups are most advantageous. Motors are from 50 to 100 horse-power, and pumps can handle 150 cubic feet of water per minute. A good example of the use of compact rotary pump groups is seen in the large Bangkok water works which now uses five sets of this kind. An original plant is found at the Coethen water works where the source of supply is an underground well. Two electric pump sets are mounted directly in the bottom of the well shaft and can be placed in this narrow space without any trouble. The electric motors are built with special insulation in order to stand the dampness.

Science

Explorations on the Indo-Tibetan Frontier, which began with the punitive expedition against the Abors, following the murder of Mr Noel Williamson, have now been in progress for three years, and have yielded very extensive geographical and ethnographical results. A total area of about 30,000 square miles of previously almost unknown country has been surveyed, extending along the entire frontier from Bhutan to Burma.

Ernest Solvay a Hostage.—Ernest Solvay, known the world over for his remarkable soda process, and one of the wealthiest industrialists of Europe, has been held by the Germans as a hostage for the payment of the $40,000,000 war levy imposed on Brussels by the Germans Dr Solvay received from the German Emperor a very important decoration and the Berlin Academy of Sciences presented him with a gold medal. Besides he is a Nobel prize winner

The American Association for the Advancement of Science will hold a summer meeting next year, viz., August 2nd-7th, in San Francisco and its vicinity The general sessions and general evening lectures will be in San Francisco, while the sectional meetings will be held chiefly at the University of California, Berkeley, with one day's session at Leland Stanford University As the meeting is to be held in connection with the Panama-Pacific Exposition, it is planned to have the scientific papers and addresses relate, so far as possible, to topics pertaining to the Pacific area

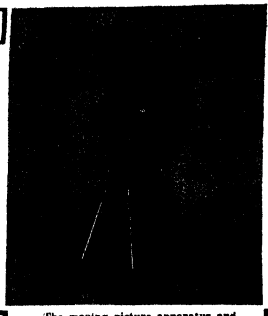
An Experiment in Osmosis. -The following is a very interesting and instructive experiment that may be performed by any one having a microscope of low power and the two chemicals, potassium chromate (K_2CrO_4) and barium nitrate ($Ba(NO_3)_2$) First make a concentrated solution of each of the chemicals and let a few drops of the chromate solution evaporate on a watch glass. Next pour out a few drops of the hot barium nitrate solution onto an object slide With the point of a moist needle pick up a minute crystal of the chromate from the watch glass and place it in the middle of the bismuth nitrate on the object slide. Now focus the microscope on the yellow chromate crystal and it will soon begin to grow and send out streamers which will wind over the slide, curving around the crystals of bismuth nitrate very much as a root curves around a stone. If no microscope is handy, "osmotic plants" may be grown in a test tube using these same chemicals. First fill the test tube with a hot concentrated solution of the barium nitrate then drop in a crystal of the potassium chromate. The so-called "plants" will grow with remarkable rapidity.

The Kara Sea Route to Siberia.—Mention has already been made in these columns of the experimental journey from Europe to the arctic coast of Siberia which was so successfully carried out last year by the Siberian Company's steamer "Correct," having on board the managing director of the company, Mr Jonas Lied, and the veteran arctic explorer, Dr Nansen It was also stated that the Russian government was doing its utmost to develop this new trade route, and had established wireless telegraph stations at the entrances to the Kara Sea for the purpose of keeping mariners advised of the ice conditions in that region This year the enterprise has been taken up even more energetically Mr Lied's company has despatched two cargo steamers, of 2,400 tons each, from Tromsö, Norway, for the Ob and the Yenesei, and these were accompanied by six vessels belonging to the government, viz , two lighters, and four river steamers destined for use on the Yenisei The cargo steamers are equipped with wireless apparatus having a range of about 500 miles, while Mr Lied has taken with him a moving-picture outfit, hydrographic apparatus, and other facilities for supplementing the commercial side of the expedition with valuable scientific work It was hoped to establish wireless communication with some of the exploring expeditions now in the Arctic

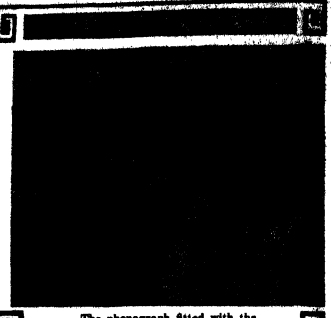
Dr. Albert Smith Bickmore, the first curator of the American Museum of Natural History, in New York, and for many years of the department of public instruction there, died at Nonquitt, Mass , on August 12th, as a result of an attack of pneumonia, at the age of seventy-five years Dr Bickmore was born on March 1st, 1839 at St. George, Me , and graduated at Dartmouth College in 1860. For the next four years, he studied with Prof. Louis Agassiz in the Lawrence Scientific School of Harvard University, and while there he became an assistant in the museum and went to Bermuda to collect for that institution During the Civil War, he served with the Massachusetts volunteers After the close of the war, Dr Bickmore spent three years traveling the Malay Archipelago, China, Japan and Siberia as well as several European countries In 1868, he became Professor of Natural History in Madison, new Colegate University, and from 1869 to 1884 he was superintendent of the Museum of Natural History When on a voyage to Europe with his father as a child he imbibed a fondness for travel, and during his connection with the museum he visited many parts of the world at his own expense, collecting materials for his public lectures.



The commutator that controls the solenoid motor.



The moving picture apparatus and solenoid motor that propels it.



The phonograph fitted with the commutator.

Combining the Phonograph and the Camera

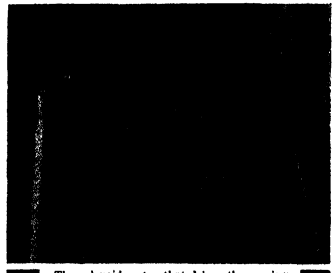
By Albert Marple

ONE of the most important of recent inventions is the electrically driven apparatus whereby absolute synchronism is obtained between the motion picture camera or projector and the phonograph. For years inventors have been trying to devise some means whereby motion pictures may be made to correspond accurately with the talking machine, thereby producing talking moving pictures. A number of machines have been presented, but without exception there has been something lacking in these. Either the talking machine would get ahead of the pictures or the projector would speed up, leaving the record on the talking apparatus far behind. The writer saw a very amusing exhibition in Los Angeles, Cal., some time ago. Talking motion pictures were the feature of the evening, and they drew a large crowd. The pictures and the phonograph record started off together and everything went well for a minute or so, when it could be noticed that the talking apparatus was gaining on the projecting machine. Soon the difference between the machines became so great that it was indeed amusing. The phonograph would reproduce a dog's bark, and a short time later the picture of the animal was thrown on the screen. The two machines failed utterly to register.

One of the latest talking picture machines in which electricity is *brought into play*, is the work of Mr. O. E. Kellum of Los Angeles. The writer has seen the apparatus in operation and can truly say that the work done by it is remarkable. From the time the machines were started until they were finished the synchronism was perfect. When the pictures opened the performer's mouth the phonograph made him sing or speak. A film five hundred or a thousand feet in length was run, with a correspondingly lengthy phonograph record having a single word or sentence in the middle and the words and the pictures corresponded perfectly.

Any phonograph and projector or camera may be used with this apparatus, there being, however, some preparation to be done to the machines. The phonograph may be run by either electricity or other motive power, electrical energy being much preferable to any other. The pin which runs upward through the center of the round disk is made especially strong, and has at its apex a bevel gear. A corresponding bevel gear connects this to a horizontal rotating rod, the opposite end of which constitutes the

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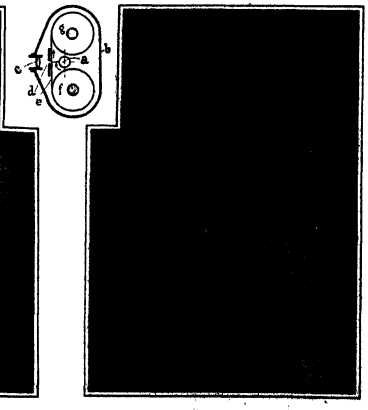
The solenoid motor that drives the moving picture machine.



Fig. 2.—Sections from a panoramic film.



Interior of the experimental apparatus, showing the mechanism.



The experimental panoramic moving picture camera.

Moving Picture Panoramas

By Dr. Alfred Gradenwitz

HOW interesting it would be to combine the panorama's illusion in space with the moving picture's illusion in time! Why not have "animated panoramas"?

As far back as fifteen years ago, a French inventor designed a "kinetorama," destined to project such panoramas on the walls of a circular hall, but the method used, a battery of ordinary kinematographs, each covering a given portion of the circumference, was too complicated to be adopted in actual practice.

A Bavarian engineer, Dr. Hans Goetz of Munich, has simplified the problem by using the ordinary moving picture camera suitably modified.

Ordinary panorama cameras are known to be based on the rotation of an objective round a vertical axis, this objective recording on a semicircular film a panorama covering an angle of 140 degrees as a maximum. Another type of panorama camera is arranged to rotate round its stand, while a film in its interior passes in front of the slot.

The accompanying diagram is a top plan view of such an apparatus: *a* is the vertical axis around which the camera *b* rotates. The objective *c* comprises an adjustable slot *d*, below which a film *e* is arranged to pass under the action of a gearing controlled by the axis, while unwinding from drum *f* on drum *g*.

When this apparatus is made to rotate once round its vertical axis, the whole panorama is reproduced photographically, or, as it were, unwound, on the film. However, it suffices to provide for a continuous rotation at a speed corresponding with the normal rate of moving picture projection (that is, about fifteen revolutions per second), in order to produce a most unexpected conversion, and to transform the camera into an ideal panorama kinematograph. The pictures thus obtained, at first sight, do not seem to have anything in common with moving-picture films, and are nothing but a panorama continually unwound, comparable to a wall-paper border (Fig. 2). However, on examining the panorama more closely, the pictures are seen to differ from one another, any moving objects occupying more or less different positions, as on the sections of an ordinary kinematograph film. In fact, the only distinctive feature of the panorama film is the substitution of a single, continuous picture for an intermittent succession of film sections.

This picture has to be projected on the walls

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Fighting the Fly in the Interest of Public Health

The Story of a Successful Crusade in Cleveland Against Flies

By Jean Dawson, Ph.D.

A WEATHER vane indicates the direction of the wind no more certainly than flies in a neighborhood indicate the presence of hidden filth. Flies were unequally distributed throughout Cleveland, and we rightfully attributed it to the difference in the amount of débris that was allowed to gather in different parts of the city. We had, however, little first hand knowledge of the sanitary condition of any neighborhood, and we determined in the early spring of 1913 to find the sources of flies in the city.

For six weeks we investigated neighborhoods in different sections of the city, making a house to house canvass and learning of conditions which were of inestimable value to us later. In the disposal of garbage all grades of civilization prevailed among householders, which was not always bounded by geographical lines; roughly speaking, Cleveland is divided into two distinct classes, those who place their garbage in some kind of a receptacle and those who do not. The receptacles used vary from a galvanized can covered tightly and placed in the rear of the lot, to the can without top or bottom, the improvised soap box, peach basket and paper sack, which allow the garbage to become scattered about the yard, emitting offensive odors which are most attractive to flies.

Those who do not use a receptacle feed the garbage to their chickens, or toss it from a convenient door or window and allow it to ferment and decay in the yard. Collectors have strict orders not to take any garbage that is not in some kind of a receptacle, or that is mixed with rubbish. The writer has seen tell-tale paths of greasy filth running down the side of a house from the window to the ground, showing where the inmates have thrown the household waste -from table-scraps to the feathers and entrails of chickens.

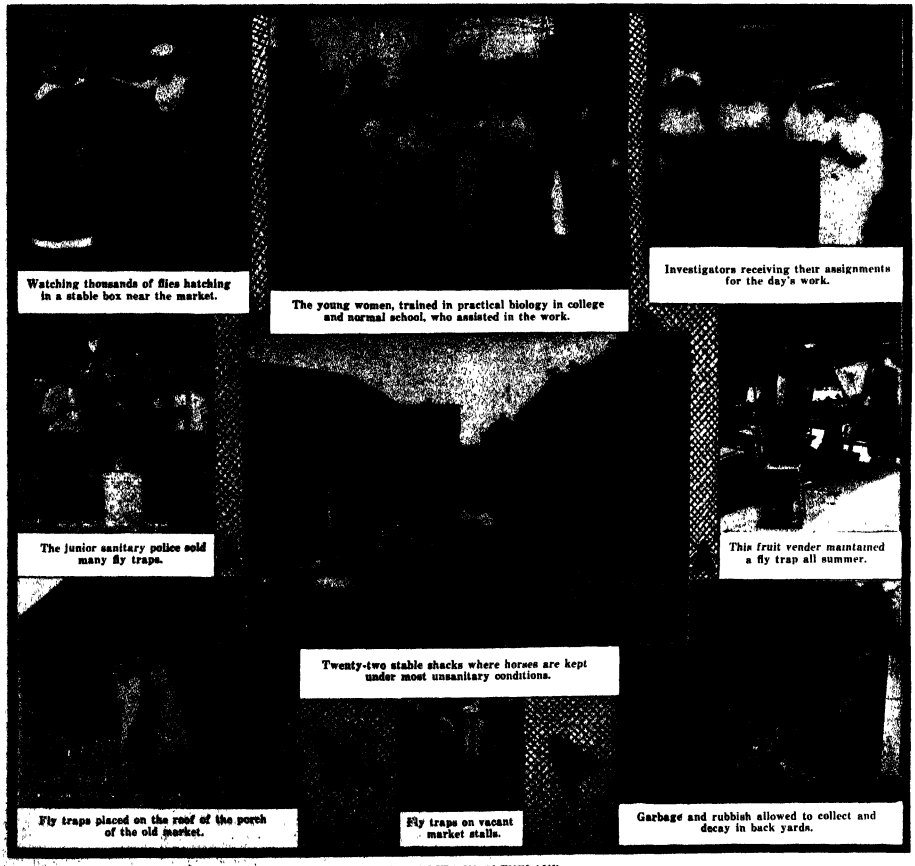
Do flies breed in garbage? Truly, a veritable paradise for fly feeding and breeding! Fortunately the millions of eggs and larvæ found in exposed garbage are killed at the garbage rendering plant before they can develop into flies. It is only in outlying districts where collections are infrequent and where it is allowed to lie upon the ground for more than a week that flies successfully breed in the garbage of Cleveland.

While only about five per cent of the flies of the city breed successfully in garbage, it is clear that an educational campaign is necessary to bring about a more sanitary deposition of the waste of our kitchens, the odors of which bring flies about homes and stores in large numbers, wherever garbage is exposed. Now, fermenting organic waste is the only food upon which the larvæ or young of a fly can live, hence it is necessary that a mother fly find such débris or she fails to perpetuate her kind. With the disposal of the sewage and the collection of the garbage, the city of Cleveland has gradually narrowed down the breeding grounds of the house-fly until it has but one left, i. e., the manure from stables. It was about the horse stables (about 5,000 in number) that fully 90 per cent of the flies of the city were breeding, and it was to the removal of the débris from these stables at least once a week that our attention was directed

About the time school closed the appropriation committee of the city council gave the campaign a great impetus by placing the sum of $2,000 at our disposal The money, which was to be drawn by us through the street cleaning department enabled us to do systematic inspection, which otherwise would have been impossible

Normal and College Girls Become Inspectors.

Fortunately the help problem did not enter to complicate matters A body of young women trained in practical biology, in college and Normal School, rallied to our call, and soon thirty enthusiastic inspectors left the office of the anti-fly campaign headquarters daily at 8 A M., returning with their reports at 1 P. M.



FIGHTING FLIES IN CLEVELAND

Their work seemed to meet a much felt need in the city. Soon a deluge of complaints and calls for help to rectify unsanitary conditions bespoke the interest the people felt and plunged the workers in the anti-fly campaign into a whirl of activity that did not abate throughout the summer.

Much of the success of the campaign is due to the indefatigable work, courage, and pluck displayed by these young women. Teachers to be, they distributed much biological knowledge while on their trips: in return they gained much first-hand information of the city and conditions of the homes, which will be of inestimable value to them in their future work of instructing the young in the ways of better living.

About the middle of July we made a thorough canvas of the city. About thirty girls working in pairs tramped eight hours a day in the hot sun, often footsore and weary, but with no thought of abandoning the difficult task. Through their untiring efforts we obtained a fairly complete record of the stables on each street, avenue, and alley in the city, with the number of horses in each, whether there was a box for the stable refuse, and most important of all, how often the box was emptied and by whom.

This information was not always easy to obtain. Horses were sometimes kept in the most unusual places; in the rear end of a store, in a shed back of a house where the horse had to go through the house in order to reach its stall, and even in houses themselves. Stepping to the door of a house in one of the most congested parts of the city one day, the writer saw a couple of horses in one end of the living room and at a table near by a woman washing her dishes. Nor was the inaccessibleness of stables the greatest difficulty—stable owners who could not speak English—those who were naturally suspicious or reticent about giving out any information upon any subject, often taxed good nature to the uttermost.

Investigation showed that general neglect characterized the conditions of the stables throughout the city. North, east, south, and west, stable refuse was allowed to accumulate, usually in heaps upon the ground without even a board to keep it from becoming scattered over the yards. Nor was this condition found in the poorer districts alone; stables back of Euclid Avenue stores and those back of grocery and hardware shops in some of the most select residential sections of the city were not cleaned in weeks and even months.

Usually the presence of a fly in a neighborhood indicates that organic filth is not far away. It was interesting to see how skillful the girls became in locating a neglected stable by the presence of flies, sometimes when even people were not aware of the presence of a stable in their neighborhood.

Law Not Enforced.

No sooner had we discovered the unsanitary conditions of the stables than we began a search for remedial measures. An ordinance passed years before, but never enforced, made it mandatory upon the part of a stable owner to provide a suitable box, and to remove all stable refuse every seventy-two hours.

To get the stablemen to provide boxes was comparatively easy. During the summer hundreds of boxes were built following our complaints. The removal of the stable refuse, even once a week, however, was an entirely different matter and involves work that is yet to be completed before we can reach our ideal, "A Flyless City."

Almost the first stable owner asked to comply with the law brought out the reason why the ordinance had never been enforced. "Yes, I'll remove the manure from my stable box once a week and be glad to, if you will tell me where I can put it. I had a farmer who promised to haul the manure from my stable, but he is too busy to bother with it in the summer." Unconsciously, this man summed up the difficulties of the situation in a few words. The city had provided no places for the disposal of manure, and we could say nothing in answer to the man's inquiry. To be sure we might have been unreasonable enough to tell him to hitch up his horse once a week and draw a mere wheelbarrow load (the accumulation from one horse for a week) miles and miles to the city limits. If he did not care to do this we might have told him to pay the customary $3 a load to an expressman once a week to remove the manure. Clearly the law was unreasonable.

Not only did this stable owner voice the difficulties in the way of removing the refuse from the city once a week, but his experience typified that of nearly every small stable owner of Cleveland. Considering the time and expense involved in removing manure, the stable owners were glad to turn to the farmer for aid. To be sure manure is a valuable fertilizer, and the farmer would collect it some time, provided of course there was a load and he could come for it when it suited his own convenience. From the health standpoint this haphazard collection of manure defeats its own end. Flies pass through their life history every ten days during the summer, and the removal of the manure after the flies have developed reminds one of the man who locked the barn after his horse was stolen.

One cannot blame the farmer for this neglect in the summer-time when his crops call loudly for attention. Some prosperous farmers needed so much fertilizer that they employed men to collect the manure the year 'round, even paying a nominal sum to the stable owners for the privilege of collecting it. This fact explains why our records show that the manure from larger stables is collected nearly every day.

It was clear to us if the law was to be enforced it must first be made reasonable by furnishing places where manure might be loaded on cars and carried out of the city. Accordingly we wrote to the different railroad companies asking for the location of all possible switch tracks where manure might be loaded. From the answers received we chose seven stations, so situated that few men would have to haul their stable refuse more than a mile. We then divided the stables of the city into seven lists according to their proximity to one of these stations.

Disposal of Stable Refuse.

No sooner was it known that we were contemplating shipping this fertilizer than a shower of orders for manure by the carload came from farmers from the surrounding country.

We now had the shipping stations and possible customers; the remaining work to be done was to get the manure loaded into the cars and shipped out of the city before the flies could develop. Had the city had sufficient money to take up the collection of the stable refuse as a municipal activity, as it had taken the garbage, Cleveland would have attained to "flylessness" with little or no further effort on the part of its inhabitants. This, however, was not to be, for Cleveland has debts that forbid further undertakings, at least for some years. Meanwhile without the financial aid of the city, we must get this refuse to the country and moreover it must be put on a paying basis.

That there is science in all trades we soon demonstrated. The street cleaning department gave us teams and men to work in several stations until we could establish a private collection. These men were hired at $4.80 a day and they collected two and sometimes three small loads, not amounting to more than two or three tons of manure. We were selling the fertilizer at 75 cents per ton free on board, and, of course, losing heavily on every carload. For that matter so were the men who volunteered to collect with a view of taking up the business permanently.

We soon learned that our failure was due mainly to the fact that we undertook to collect from all stables, large and small alike, once a week. A little figuring taught us that this could not be done, at least not in the case of the small one and two-horse stables. Government estimates show that the manure from a single horse stable amounts to between 5 and 6 tons a year. Estimating the price of manure at even a dollar a ton free on board would make the manure produced in a stable for a week amount to between 9 and 10 cents. It was clear why we failed: no one could collect from a one-horse or even a two-horse stable every week for the price of the manure itself.

That the collection of manure could be made to pay was demonstrated by Mr. B., a man in the market region, who had been in the business of shipping fertilizer to farmers for several years. Mr. B. kept eight and ten teams busy, and was prosperous enough at least to own his own switch-track in the very heart of the city. He had been collecting from the larger stables once or more a week and from the smaller stables once or twice a year—whenever there was a load. We also learned that Mr. B. paid his men by the ton and that each man brought in four and five large loads a day as against our two and three small ones, when we paid by the day.

As soon as we began to enforce the law, Mr. B. was told that he must collect at least once a week from all stable-men with whom he had contracted, and then our inspectors warned the smaller stable-men that once a week they must either pay some one for hauling their stable manure or else haul it to the car themselves.

At first many of the stable-men did not take our efforts seriously. We would warn men that they were violating the law, and a week later when we went back we would find that nothing had been done. This state of affairs went on until, growing desperate, we appealed to the city attorney for help. After due study of the situation, he told us that as citizens we had a right to complain of the violation of the law and advised us to send our complaints to the police court direct.

When this fact became known, almost all the delinquents were willing and anxious to comply with the law. Ten carloads of manure instead of eight were taken from the market district weekly. Only a few neglected stables remained, but unfortunately they were enough to supply the entire district with flies. Still the owners of these stables, however, promptly complied with the law after being called into the police court and golden-ruled. That these men kept their word and cleaned up was strikingly demonstrated by the almost magical disappearance of flies from the entire market district.

The work of cleaning stables done in the market district remains as the ideal for all parts of the city, to accomplish which is a work for future campaigns.

Protecting the Central Food Supply.

It is of small use to urge the elimination of flies from the retail stores if the food is contaminated before reaching them. For this reason much effort was used to keep flies from the market and commission house district.

With the approach of warm weather we were comforted with the thought that at least we should not have to fight a countless number of possible offspring from the 50,000 flies that had met a timely death during the winter campaign. We could not, however, congratulate ourselves that we had killed the last pair of flies or that there was any lack of organic débris in which flies might breed, in the city. Not to be caught unprepared, we started the work of protecting the city's food supply in the markets and commission houses before the summer had well begun. This is by no means an easy task; first, because the odors of food are attractive to flies, and second, because the markets and commission houses of Cleveland are situated in the oldest and most congested parts of the city. The unfavorable location of these buildings did not, however, discourage us. It was here that we determined to apply the acid test to our methods of fly extermination. In this section of the city, we put forth our supreme effort, and it was here that we gained our best results and worked out the plans for all future work in eliminating flies from the city.

In this, the most congested section of the city, with its varied business interests, its crowds of humanity living in houses, the condition of which is absorbing the attention of the city's experts, the flies disappeared so completely at the very height of the fly season (the last of August and September) that a broken melon might lie in the streets for hours and not have a fly appear to feed upon this most favored food. The unscreened windows and doors of the markets stood wide open, and so few flies made their appearance that were it not for the sultry heat, one might have imagined that it was early spring or winter.

These results crowned the efforts of weeks of the most tireless labor in the trapping and poisoning of flies and in the clearing away of the fly-breeding places.

The winter campaign was barely over, before we began catching flies on their way from their breeding grounds to the markets. With the aid of the alderman of the ward, we found merchants and restaurant keepers who were willing to keep large traps baited in front of their places of business, provided we furnished the traps. All summer long dozens of traps, baited with vinegar and sugar, beer and stale fruit took up flies from the neighborhood as a vacuum cleaner takes up dust. These flies were prevented from entering the markets or going back to the fermenting débris to breed new generations. These traps proved a benefit not only to the merchants who baited them, but to the entire community as well.

Later, to demonstrate to the general public the efficiency of trapping flies, we placed large traps before the fire and police stations throughout the city.

Up to the middle of July, we could count at no time more than 10 to 50 flies, in either of the large markets; later, however, they became more numerous, breeding in stable manure not over a stone's throw away.

Theoretically, starting the day with a flyless market is easy; practically it is most difficult. Traps baited with an attractive bait or poison set about in a clean, dry market resulted in a speedy elimination of flies. Success depended upon the food in the trap being much more attractive to the flies than that to which it had access on the outside, or upon the fly being hungry and thirsty and the trap containing the only available food.

Open daily, the Sheriff Street market was successful with the first of these methods. At all times large traps, baited with beer and bread were kept upon a central stand, and on Sunday, when no food was exposed, plates of poison were placed about the market. The Central market had no room for traps and depended upon getting rid of flies on the days when the market was not open to the public. The time for catching flies being limited, it was necessary that every merchant should leave his stall clean so that on the off-market days the flies would become hungry and rush into the traps for food. Herein lay a difficulty.

Merchants hitherto had cleaned their stalls at their convenience. Sometimes the débris of Saturday was not cleaned away until late Monday afternoon, and in the meantime the flies gathered,

attempting to economize on the offals left on counter, floor, and tan-stands and on over-ripening fruit.

Constant vigilance, which at first required a daily inspection of every stall in the market, brought about a co-operation on the part of the merchants that was productive of best results. The market underwent a thorough scrubbing was done and done on time. Clean aprons, counters, and meat blocks soon lent an attractive air to the place, which the merchants were not slow in recognizing as a good business asset. White tile fly-stands took the place of old wooden ones that had for years been an eyesore and furnished a favorite haunt for all of the flies in the neighborhood. With the change in the appearance of the market, there came corresponding changes in the market-men themselves. Dark looks and murmurs about women who interfered with other people's affairs were gradually replaced by friendly nods and later by proffers of advice and plans for still further improving the market.

The fight against the fly and the removal of the filth in which it breeds has passed from a private to a municipal activity. At a meeting of the mayor and his cabinet in the early spring it was decided that the work of eliminating flies from Cleveland was of such grave importance that it should be rightfully assumed by the city as part of the work of the Division of Health in the Department of Welfare.

Wireless Communication in War

FROM time to time in the past the question has been raised as to the efficiency of wireless communication in time of war, and the possibilities of crippling the communications of an enemy have been discussed, but so far in the course of the European conflict nothing bearing on the subject has been reported that has added to our general knowledge of the questions involved. The opinion that apparently has prevailed was that it would be perfectly possible to completely disrupt and suspend all wireless communication by means of interference of very powerful waves of a different length sent out by an enemy, or "jamming" as it is termed; but it would appear from an article by Commander F. G. Loring of the Royal Navy in the *Naval Annual*, that tactics of this kind are by no means successful. The author's remarks on this subject are as follows:

"Interference caused by other stations, such as international interference of an enemy, is of far less importance than is generally supposed. It is an extremely difficult thing to seriously 'jam' a well-organized communication, and there are many ways, both technical and methodical, of defeating such an intention.

"A good deal of misapprehension exists in the minds of the public concerning this question of 'jamming.' It is to a large extent a question of degree, and in the present state of development of wireless telegraphy it is a far more important problem from a commercial point of view than from a strategical.

"The success of a commercial line of communication depends on the amount of traffic that can be handled in a given time. Interference and atmospherics may exist to such an extent that the service cannot be carried on on a remunerative basis. From a strategical point of view the case is different. It is desired to get a comparatively small number of messages through to some distant point with absolute certainty—messages which in most cases cannot be delivered by any other known means. It is the opinion of the writer that, given good apparatus and a highly-skilled personnel, it is absolutely impossible for an enemy to prevent a wireless message reaching its destination. It is not easy even to delay it for any considerable time.

Ineffectiveness of Intentional Interference.

"As an instance of the ineffectiveness of intentional jamming, I find in a report of the wireless communications of the 1906 Naval Manœuvers the following interesting paragraph: 'No serious interference was caused by intentional or unintentional jamming, though the enemy resorted to this for forty hours without ceasing.' In connection with this question of the possibility of effective jamming by an enemy, it must not be overlooked that by attempting it the enemy is certainly putting his own wireless communication completely out of action for the time being, while it is very doubtful if he is seriously inconveniencing the communications of his more distant opponent. Severe atmospheric disturbances are far more difficult to deal with than interference, and there are undoubtedly times and places when it is absolutely impossible for an operator to receive a message for several hours at a stretch.

Code Messages.

"The danger involved through the interception of a fleet's signals by an enemy is also, in my opinion, often over-rated. Co-operation between operators and full knowledge of each other's methods is extremely important when handling difficult code messages, and the more perfect the organization, the more difficult it is for a German spy-ator to make down with the necessary accuracy the groups of a code message. He cannot ask for the repetition of doubtful groups, and he has no intimate and daily familiarity with the methods of his opponent to assist him in his task. And, after all, giving the enemy every advantage, giving him a perfect record of the signals, the key of the code to his hand and equal facility of skill and language to translate it for use—a most improbable combination, it must be admitted—he has still failed to prevent the all-important information reaching its destination."

Payment of Patent Fees Abroad

THE transmission of money for the payment of patent fees abroad is of much interest to inventors, and has had the attention of the Interior Department and the Department of State. As a result of correspondence between these departments, it is understood that the State Department has transmitted a note to each of the countries with which communication is now more or less interrupted, setting forth that American citizens have called the attention of this Government to the necessity of making payment of taxes upon or to secure the filing or amendment of patent applications or of working patents within specified time in order to maintain rights in the various European countries and suggesting a reasonable extension of the time limits.

The desired action has been anticipated in some countries, France, for instance, having issued a decree suspending from and after August 1st, 1914, the periods granted to holders of certificates of guaranty issued on the occasion of expositions organized in France at the instance of the administration or under its patronage to claim the protection of which their discoveries, designs, models, or trademarks are legally susceptible; also suspending the period during which a person depositing a design or model is entitled to require the maintenance of his deposit either with publicity or in secret form; and suspending from and after August 1st, 1914, and until a date to be fixed by a decree upon the cessation of hostilities the legal periods within which holders of patents must pay the annual taxes upon their patents. The suspension is applicable to the payment required to be made upon the filing of any application for a patent of invention or certificate of addition and also suspends the period of working of a patented invention in France. The provisions of the decree are not applicable to patents which prior to August 1st, 1914, had become forfeited. Periods fixed by the German patent office for actions on pending applications have also been extended.

It is also understood that certain extensions of time for the payment of patent fees are provided for by a decree in Sweden and that certain extensions are contemplated in Austria and Hungary.

Motion Pictures in Schools

A WRITER in *School Science and Mathematics* reports in detail the extensive and varied use now made of motion pictures in American schools. The following cases are illustrative: At the Sheffield Scientific School (New Haven) an exhibition of "The Story of Pig Iron" was so successful that the authorities are negotiating with other firms for pictures along scientific lines. The Kansas University Extension Department has a series of films teaching lessons in morals for the use of the Kansas public schools. Fitchburg, Mass., also uses moving pictures for moral instruction in schools. The school authorities at Parsons, Kansas, have a contract with the manager of a local theater to give special performances for school children two Friday afternoons a month, the films being selected by the superintendent. The United States Military and Naval academies both use motion pictures. Domestic science is taught with the aid of motion pictures at the University of Minnesota. Minneapolis and St. Paul use motion pictures in the public schools to teach geography and history.

The Current Supplement

THE current SCIENTIFIC AMERICAN SUPPLEMENT, No. 2019, contains an unusually varied assortment of interesting, valuable, and timely articles. Lighthouses for the navigation of the air discusses a practical problem of which little has been written, and gives a chart and list of the light stations that Germany has already established for the guidance of her airships in time of war. The article on heredity is the first instalment of the address of Prof. William Bateson before the British Association for the Advancement of Science, which is published in full, and is a discussion of the principles of evolution and the secret of life that will be read with keen interest. A sketch of Prof. Bateson's history is also given. Numerous examples of results secured by the use of the new Coolidge X-ray tube show the new power that has been placed in the hands of scientists. A new way of selling will interest every business man. Other articles tell about the manufacture of ice; navigation without logarithms; liquid crystals and biology; and many other valuable topics.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Our War Number

To the Editor of the SCIENTIFIC AMERICAN

A war number! As if it were really the first time the SCIENTIFIC AMERICAN has included a war number.

When war was declared about a month ago, I for one pulled out back numbers of the SCIENTIFIC AMERICAN and also looked up the war section of the reference book, and found out more about the ratings of the belligerents and their equipment than I have since found from dozens of periodicals.

The SCIENTIFIC AMERICAN must have had inside information about the war, for I found articles about the possibilities of a Zeppelin attack on London, the guns of the warships, the Kiel Canal etc. of only a few months date back. Being peaceful, I had "skipped" most of these articles when they came out first, as they seemed to have little interest then.

A *peace* number ought to follow soon.

Minneapolis, Minn. ANONYMOUS

Technical Writings by Untechnical Men. A Defense.

To the Editor of the SCIENTIFIC AMERICAN

My attention was recently called to a letter published in your esteemed publication, entitled "Technical Writings by Untechnical Men," signed by Mr Charles S Rhindfoss, secretary-treasurer the Foundation Company, New York. In this letter Mr Rhindfoss caustically criticizes an article by me, entitled "Skyscraper," which appeared in the May issue of the *Atlantic Monthly*, and protests that any than technical men should be permitted to record impressions inspired by great engineering accomplishments in any but technical words and phrases.

Such literary criticism by nonliterary men cannot be ignored, as is my natural inclination in this instance. The discussion Mr Rhindfoss opens is a wide one. Were he and others of his mind to dictate, literary and artistic endeavors must perish, unless writers and artists limit their efforts entirely to the daisy of the field and the color of a woman's eyes.

That I have failed to label with exact technical phraseology certain materials that entered into the construction of the building I ignore as childish querulousness. That I have seen certain things and received imaginative impressions in the amazing construction of this great building that Mr Rhindfoss cannot see nor feel is important, for here is defined the purpose of my article, the purpose of any purely descriptive writing or painting.

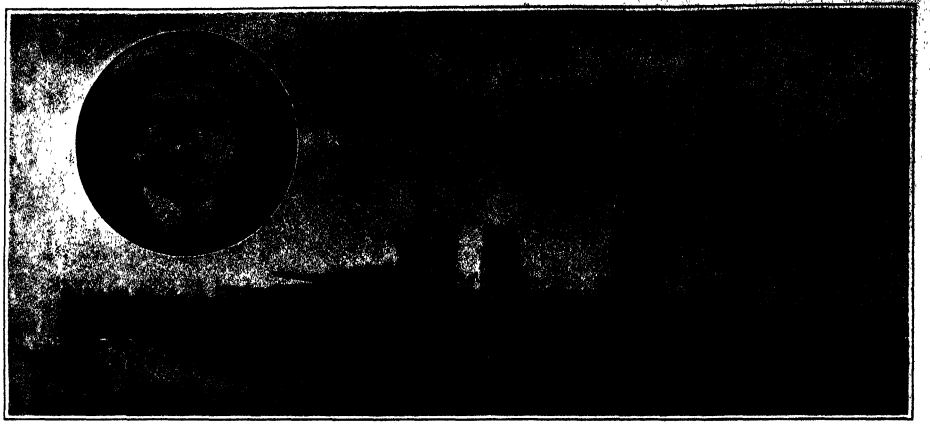
I must beg to advise my critic that my purpose was not to afford a technical description of the building of an American skyscraper from which anyone might construct a similar edifice, no more than was it Mr Pennell's purpose in the Panama lithographs to offer working drawings for the digging of future canals. Mr Rhindfoss confuses literary descriptions with technical specifications; paintings with blue prints. That he prefers in each case the latter is natural; that he fails to see anything of value in even the intention of the former, fails in fact, to see the former at all, is regrettable, but it is not given to all to see clearly.

Mr Whistler, an artist of recognized reputation, once painted a picture of Battersea Bridge. At a certain famous trial during Mr Whistler's lifetime this picture was produced as evidence, and the question was asked by someone present, "Which part of the picture is the bridge?" I am citing this rather extreme case to prove to Mr Rhindfoss that, if he intends a critical journey through the fields of art and letters, he must be prepared for more disturbing lines, colors, words, and phrases than he has yet encountered.

Should Mr. Rhindfoss care to continue his literary criticisms further, I would suggest that his condemnation of a poem entitled "Pariacelsus," by the late Robert Browning, would be of extreme interest and might lend still more definitely to establish Mr Rhindfoss's exact place in the fields of artistic and literary criticism.

And may I add in closing that, when next my worthy critic descends into that sweet atmosphere of his enclosions (which he defends so vigorously), and descending catches one last glimpse of the sunshine touching the great walls of the city, and the "wisps" (I will use the word) of steam blown back from stack and chimney like soft plumes bending before the morning breeze, let him remember that life is not all dry dust of technicality, and that imagination is even sometimes responsible for the building of those very foundations in which he so closely dwells. JOSEPH HUSBAND.

Winnetka, Ill.



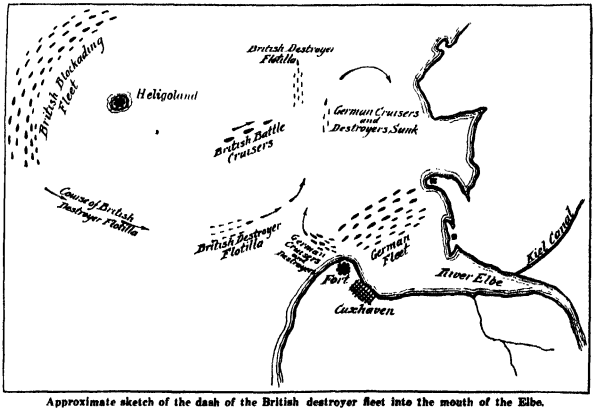
Admiral Sir David Beatty and the battle-cruiser "Lion," which gave the "coup de grace" to the German cruisers.

First Naval Engagement of the War

Five German Scouts and Destroyers Sunk at the Mouth of the Elbe

THAT was a thrilling naval fight which took place August 28th between Heligoland and Cuxhaven Heligoland is a strongly fortified island, off the mouth of the Elbe. It forms the base for the German North Sea destroyer fleet. The island is strongly protected with the most modern coast defenses—heavy long-range rifles, mortars, quick-firers, and mine fields. Similar defenses exist at Cuxhaven, and on the opposite shore of the Elbe

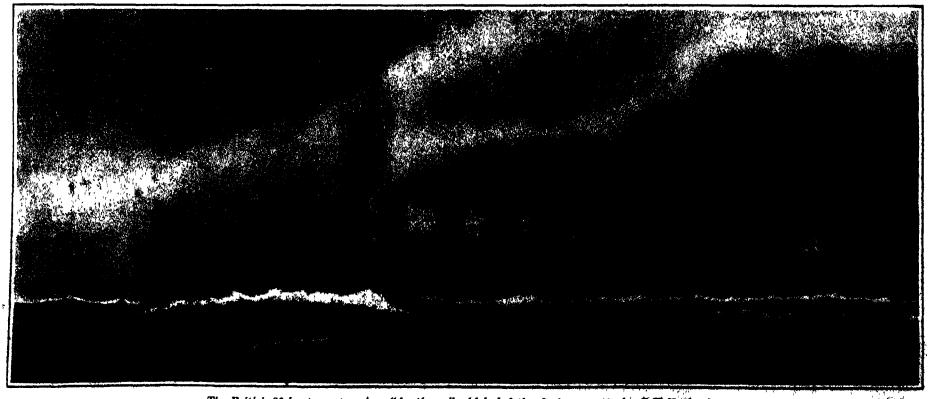
It is now well established that a part of the German fleet has fled for refuge in the broad estuary of the Elbe River, behind the guns of its coast fortifications These protected waters are probably the rendezvous of those destroyer flotillas with which it has been supposed that Germany, in the event of war, would threaten the coasts of England and make successful raids against any British fleet operating in the North Sea.



Approximate sketch of the dash of the British destroyer fleet into the mouth of the Elbe.

Failing any attack by Germany, the British admiral decided to send in a force of destroyers to draw the German destroyers and scout cruisers out into deep water, and, to quote the official report, "engage them at leisure in the open sea." The ruse was successful, and the daring dash into the zone of fire of the coast fortifications resulted in a sharp fight, in which three of the fast scout cruisers of the German fleet and two destroyers were sent to the bottom with some eight hundred of their crews, without the loss of a British ship.

The British naval constructors are particularly pleased with the fact that the light armored cruiser



The British 30-knot scout cruiser "Aretusa," which led the destroyer attack off Heligoland.

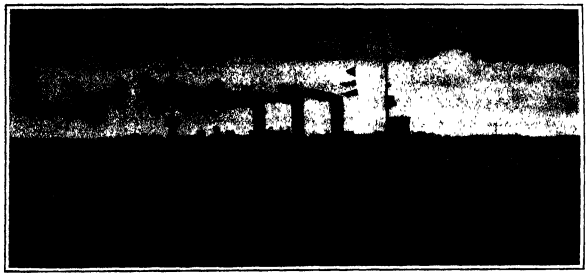


Date, 1914. Tons, 980. Speed, 35 knots. Guns, three 4-inch. Torpedo tubes, 4

The "Laurel," one of the British destroyers sent in under the guns of Heligoland to lure the Germans into the open.

"Arethusa," a new 30-knot type, which had been in commission only a few days, after an engagement of twenty-five minutes at 3,000 yards with two German cruisers, was able to drive them off. Later, she was attacked by two other German cruisers, the "Köln" and "Mainz," of 4,350 tons, 27 knots speed, and contributed to the sinking of the "Mainz." The "Arethusa," which flew the pennant of the commodore in command of the First Fleet, carried 2½ inches of side armor, and a battery of two 6-inch, four 4-inch guns, and four 21-inch torpedo tubes, led into action a destroyer flotilla composed of some of the latest British ships of that type. We illustrate one of these, the "Laurel," built in 1913, 980 tons, 30 knots speed, armed with three 4-inch guns and four 21-inch torpedo tubes.

The object of the British movement was to get the German fleet to do a little fighting. A month of the war has passed by; and it cannot be said that the activities of their ships have been of a character to shed any peculiar luster upon the naval forces of Germany. The principal achievements of the fleet have consisted, in spite of The Hague Convention, in strewing some of the most frequented highways of peaceful commerce with



Date, 1910 Tons, 4,350 Speed, 27 knots Guns, twelve 4 inch

The 27-knot scout cruiser "Mainz" and sister ship "Köln," sunk by British in the Heligoland fight.



Date, 1911 Tons, 650 Speed, 32.5 knots Guns, two 4-inch. Torpedo tubes, 5

Two of this "V" class of German destroyers were sunk in the Heligoland fight.

floating mines of a forbidden type, indeed, the triumphs of the German navy, thus far, have consisted more than anything else in the sending to the bottom of merchant ships of all nations, steaming, peacefully, on the regular trade routes of the merchant service.

The world has heard so much about the surpassing qualities of the German torpedo service, that we cannot but feel there must have been a growing wonderment in the British blockading fleet that the Germans should not have scorned to remain supine under the fortifications of Heligoland and Cuxhaven, but rather should have preferred to assist their hard-fighting army by venturing forth in an effort to stop the transportation of a British army to the Continent.

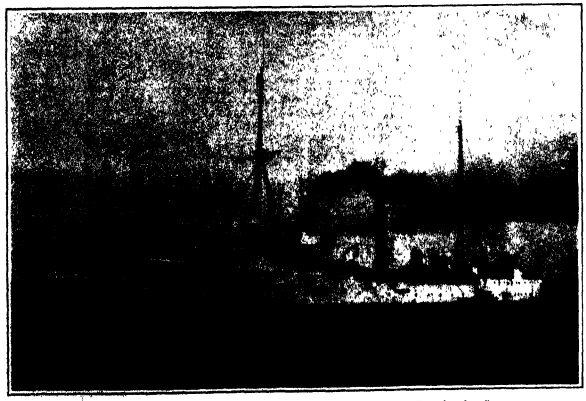
Whatever the predisposing cause, we now know that the British determined to "trail a red herring," if we may be pardoned the use of a term so unnautical, across the front of the blockaded German fleet. Hence, the dash of the "Arethusa" and "Fearless" with a fleet of destroyers past the guns of Heligoland.

The bait was too tempting not to be swallowed, and several German cruisers with a flotilla of destroyers dashed out to seize so easy a prey. The British, spoiling for a fight, did not hesitate to give battle against superior numbers, and for twenty-five minutes the two cruisers and the destroyers gave battle, under odds as great as those against which, a few days before, the British held the Germans at bay for four days and removed unbroken in the north of France. Following their plan of operations, the British drew away to the open and out of the shelter of the Heligoland fortifications, making a fight against odds which must go down as one of the brightest instances of pluck and daring in the annals of naval warfare. When the Germans had been drawn into the open, the British battle-cruisers of the "Lion" type, fulfilling their part of the programme, swept down and sank three German cruisers and a couple of destroyers with a few well-placed shots.

The importance of this brilliant little fight is not to be measured in terms of the loss of men and material; although the German fleet was reduced to the extent of three of its crack scout cruisers and two destroyers, its chief significance lies in the showing of the relative maneuvering abilities, strategy, and gun-fire of the two fleets.

This was the first time that the brand-new German fleet had a chance to show its qualities, at least in a sea fight involving numbers, and it must be confessed that the failure of four light cruisers of greater size to sink the "Arethusa" and dispose of the destroyer fleet would seem to suggest that German naval gunnery has room for improvement.

It is about time for the German navy to be doing something. The army has made good by violating the neutrality of Belgium, to which the honor of the German nation was pledged, and rushing an army in overwhelming force across the unfortified frontier of northern France; and the world at large, and surely the German people themselves, are waiting for the great German dreadnought fleet to show what it can do in a battleship engagement, when the tables are reversed and the advantage of numbers is with their opponents.



Date, 1901. Tons, 2,060. Speed, 21 knots. Guns, ten 4 inch Torpedo tubes, 3.

The German cruiser "Ariadne," sunk in the Heligoland fight.

Asphalt Paper Pipes

IN Austria pipes made from a special grade of German asphalt paper have just been introduced with promise of great commercial popularity. They are light and slightly flexible, with the great advantage that there is no electrolysis from stray currents and no rusting. The patent owners, the Anglo American Bank, insist that this piping can replace pipes of iron, copper, and clay for all purposes except carrying hot liquids, concentrated acid and petroleum products.

Antwerp and Its Defenses

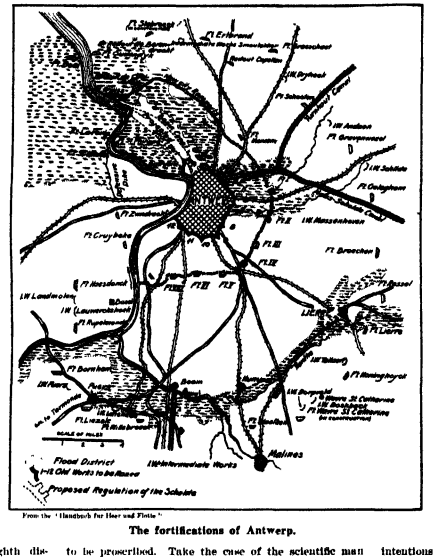
IN 1859 Antwerp began the reconstruction of her defenses under the direction of Brialmont. The old ramparts were removed and the Alba citadel was razed in 1874. But in 1869 it was found that the new enceinte and the chain of eight forts surrounding it on the right flank of the Scheldt (numbered I to VIII in the map) no longer met the requirements of the day. On the right bank Fort Merxem was added on the north; on the left bank Forts Cruybeke and Zwyendrecht were built. In 1877 work was begun on a new and advanced line of fortifications (Forts Waelhem, Lierre, Rupelmonde, Schooten, Cappellen and Duffel), which were intended to protect the passages across the Rupel and the Nethe.

After parliamentary discussions which lasted for years it was decided on January 24th, 1906, to remove the city ramparts built by Brialmont, and to rely upon the inner line of forts. Fort VIII was to be removed, and the inner line of forts was to be connected with a line of defenses, which was to be continued to Fort Merxem, and over the Redoute de Orderen to the Scheldt. The long northeastern line will lie parallel with the canal that is being built to straighten out the river and with the harbor basin to be constructed on the right bank. The old fortifications, which in 1906 it was decided to remove, constitute the first engineering district, whereas the new fortifications in the northern part as far as Fort IV constitute the second, and the southern portion the third. The new circle of forts will complete those built since 1870, and will lie considerably in advance of these. To the north they will lie four kilometers, to the east more than eight kilometers, and to the south more than twelve kilometers from the new ramparts, since they extend so far beyond the River Nethe and Rupel that they will not prevent offensive operations. The northeastern section extends from the lower Scheldt as far as the Turnhout Canal and embraces besides forts Stabroeck, Ertbrand, Brasschaet, and Schooten, the intermediate works of Smoutakker, Cappellen, and Dyck (fourth engineering district. The fifth engineering district extends as far as the great Nethe with the forts Gravenwezel, Oelegheim, Broechem, Ressel, and the intermediate works of Audaen, Schilde, and Massenhoven. The sixth engineering district extends to the Dyle with the forts Lierre, Koningshoyck, Wavre, Ste Catherine, Waelhem, and the intermediate works of Tallaert, Boschbeck, Dortpveld, and Duffel (railway redoute). The seventh district extends to the upper Scheldt and includes forts Willebroeck, Liezele, Bornhem, and the intermediate works of Letterhelde and Puers. Six forts and five intermediate fortifications were to be erected on the left bank of the Scheldt, between Doel and Steendorp (Rupelmonde until 1908), in order to complete the ring; but for the time being the Belgians decided to content themselves with the two forts Steendorp and Haesdonck, as well as with the intermediate works, Lauwerckshock and Landmolen. This leaves a wide gap which interferes seriously with absolute protection against the bombardment. These works together with the more rearwardly lying Cruybeke, Zwyndrecht, and the dike comprise the defenses of the eighth district. The ninth district includes forts Ste. Marie, La Perle, St. Philippe, Doel, and Oudendyk, as well as the old Redoute de Orderen and de Berendrecht; in other words, the works which serve primarily to block the Scheldt. The circumference of the entire ring of fortifications is about 100 kilometers (62 miles).

It was with the utmost difficulty that late Gen. Henri Alexis Brialmont of the Belgian army succeeded in inducing the Belgian government to carry out his plans for the defense of Antwerp, and then only after the Russian general, von Todleben had approved his plans. From the very first the defenses attracted the attention of military men largely because Brialmont had discarded the bastion system prevalent in France and Belgium, and had adopted the polygonal system of the modern Prussians.

In 1883 Brialmont went to Roumania in order to devise the present system of Roumanian defense. Austria objected to his activities, with the result that he was retired. In 1884, however, he re-entered the Belgian service. Under his directions and according to his plans the defenses of Namur and Liittich were built between 1888 and 1892. In 1892 he left the army and became a member of the Belgian Parliament. In the same year he went to Constantinople in order to give an expert opinion on the fortifications of that town. His suggestions were adopted, but have not thus far been carried out. Brialmont devoted the latter part of his life in urging Belgium to adopt the general European system of compulsory military service. He also fought hotly for the preservation and extension of the defenses which he had designed and built for Antwerp at a time when it was considered advisable to do away with the old defenses and to transfer the new girdle of forts beyond the Rupel and Nethe. Brialmont died on July 21st, 1903, in Brussels.

The foregoing facts are taken from the "Handbuch für Heer und Flotte," a military cyclopedia which is being published by Richard Bong & Co. of Leipzig.



From the "Handbuch für Heer und Flotte."

The fortifications of Antwerp.

Random Reflections

By Our London Correspondent

THE coercive power which a single idea may acquire is really rather remarkable. I happen to be living in England at present, for instance, and I can think of nothing but the war. Not that my thoughts are continually occupied directly with the war (although in the face of special war editions published nearly every hour that is almost true), but they oscillate about it as a center of attraction. It dominates my thoughts and modifies the intellectual habits of years: so that my random reflections will very possibly be less random than usual.

But this unification of ideas may not be without some compensating advantages. It lights up in a particularly vivid manner certain issues which a scientific man is disposed to take for granted. It leads me to wonder whether certain kinds of scientific research ought not to be proscribed. Take the case of the scientific man who invents a new and powerful explosive. I suppose that to some extent he benefits humanity. Doubtless the very existence of the explosive confirms or contradicts certain theoretical points, and to that extent we, and particularly those gentlemen who live among test-tubes and galvanometers, have our knowledge extended. Also, I suppose engineers who want to remove an inconvenient mountain or so in order to run a railway for an enterprising group of benevolent financiers find the stuff useful. But there is the other aspect of its applications. It makes war more horrible.

Now if war were made horrible to the extent of being rendered impossible, it would doubtless be a desirable consummation. But it is not at all obvious that to leave war possible and to intensify its horrors is a desirable thing. It merely means that the death roll becomes greater. The fact is that in mankind's present stage of partial civilization, certain branches of scientific research are probably more dangerous than beneficial. In olden times it was thought that dreadful penalties waited on men who inquired too curiously into some of the secrets of Nature; and as long as the possibility exists that the fruits of our intelligence may be placed at the service of our primitive savage instincts, this dark menace will wait upon our scientific advances. Brotherly love and election theory, charity and the law of gravitation, should be taught contemporaneously. A trained intelligence and far-reaching scientific knowledge may leave its possessor a brute—equipped. Yes, this war teaches the scientific mind humility; it is not in science alone that we need salvation.

The fact that the application of science to war merely intensifies its horrors leads one to a radical treatment of this terrible war question. Let us, for the sake of argument, agree that man is not yet sufficiently developed to refrain from waging war—that he will not be advised, for instance, to substituting an intellectual contest for a physical one; that he will not let, say, a game at chess decide the issue—then let him at least strive to mitigate the horrors of war as much as possible. Let all nations agree that science shall not be pressed into this service. Then let the war lords pare their millions of men into the field armed with boxing gloves. They could fight to their hearts' content. Strategy, tactics, and the other ingenuities would still have full scope. But instead of death and disablement, widows and orphans, we should have bloody noses and black eyes. A conscript, who in private life is a sedentary clerk, would probably find a European war a healthful and invigorating experience. War would not be quite so unutterably stupid as it is at present; its horrors would have vanished, and it would be nothing like so costly. If serious injuries were still inflicted, the War Office could design improved boxing gloves. They could be of the dreadnought class and have extra padding. Ample scope would still exist for differences in military training. One nation would teach its troops to lead with the left and another would teach them to lead with the right.

This may sound farcical, but really, isn't war at the present day farcical? A farce is a kind of exaggerated comedy, but cannot a tragedy be exaggerated to a farcical point? And war is an anachronism—a frequent element in farces. The glories of war have departed. To fight bravely in picturesque panoply against equally picturesque infidels in far eastern and romantic lands to rescue the tomb of the Christ is something at least poetic. But for a modern educated man to be told that certain people he greatly likes and respects are his enemies, and that he is to fight for some cause he does not understand, but which he views with great suspicion, and that his fighting will in all probability consist in walking over a piece of ground which has been mined and being incontinently blown up—well, it doesn't rouse enthusiasm. People are so suspicious about wars nowadays. One wonders even if patriotism isn't rather stupid. One has the preliminary thrill; there is flag-wagging, the blast of a trumpet, the glorious traditions of the Fatherland, and then this vague but persistent vision of a fat, beady-eyed financier lurking in the background. We have been sold so many times, one becomes wary.

One has the feeling that to be an enthusiastic fighter in a modern war one must not reason too closely. That is why some scientific men don't seem very patriotic. It is so difficult to break life-long habits, and the trick of clear-headedness, once acquired, is not easy to shake off. One could fight wholeheartedly in a war for the end of war, but in no other sort of war whatever. Whatever one's nationality, the country to fight for, if fight one must, is the country whose future intentions are most pacific, which is prepared to do most to foster the arts and the sciences, to develop an increasingly desirable social state, to preach and practice charity and brotherly love, and to strive single-heartedly for universal peace.

Effects of Immigration in France

OWING to the low native birthrate in France there is a continual immigration of a large number of foreigners. While some French people rejoice at this, others fear that it may be a case of the gradual loss to the French race of its distinctive characteristics. The number of foreigners resident in France is about 1,200,000; some are merely temporary sojourners, and of the others a certain number remain celibate. Although the data are not very numerous, Dr. Laumonier, in the *Gazette des hôpitaux*, publishes the results of his researches on this subject, these results being distinctly satisfactory. It appears that the children of these mixed marriages, in their features and the form of their bodies, approach more nearly to the French type than any other in sixty cases out of a hundred in the first generation; in the second generation the French type is found in seventy cases in the hundred and in the third generation in eighty cases. It appears from this, therefore, that the foreign element is gradually absorbed, and that no denationalization is to be feared as a consequence of these mixed marriages.

Brief Perils of a Reel Hero

A SERIALS as they do to the eye only, motion-picture dramas must necessarily be full of action. Hence it is that the dime novel plot, with its "thrill in



Hovering over the speeding train.

every chapter and throb in every line," provides an excellent scenario for the kinematograph. Unfortunately the film playwright labors under a serious handicap. "Could it really be done?" is a question that never bothers the author or reader of dime novel literature. There are no bounds to his flights of imagination.

The villain is escaping from the pursuing detective, on board a fast express. How shall he be apprehended? Simple enough. An aeroplane is faster than a train. The dime novel writer would have a flying machine handy. The detective would impress the aviator into his service, pursue the fleeing train, overhaul it, and drop from his flying car to the swaying roof of one of the railroad coaches.

It is easy enough to do this in print, and served with a good dressing of vivid adjectives, it can be turned into a most exciting episode. But the film playwright cannot give his imagination such free rein, for his play must be actually performed before it is put on the film. The idea of boarding a moving train from a flying machine, we should suppose would be too perilous to be even tried. But an enterprising film company found a man who was willing to risk his neck in the attempt. The feat was tried and accomplished, as the two photographs at the top of the page attest. We are indebted to *Sketch* for these two illustrations.

Hair Balls in Cows' Stomachs

THE accompanying photograph shows a ball of hair obtained from the stomach of a cow. Ruminants when licking themselves or their young swallow hairs which agglomerate into balls in their stomach. Eventually they grow large enough to irritate the stomach, setting up contractions of the latter and the esophagus which result in the ejection of the hair. Sometimes the balls grow too large to pass through the digestive tube, and cause the death of the beast.

The exterior of the ball here illustrated is as hard as wood. The photograph shows it cut in two, to reveal the interior, which is matted like felt.

A Searchlight for Sportsmen

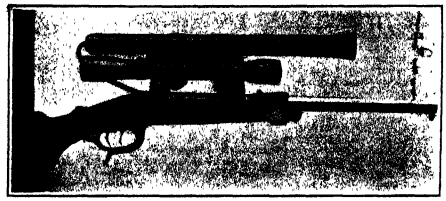
By Our Berlin Correspondent

ENDEAVORS have been made repeatedly, but hitherto without any very satisfactory results, to design a source of artificial light, enabling shooters to indulge in their sport even by night. Practically every sportsman has on his shooting grounds some game or vermin which he is unable to get hold of by day, as it is too sly to leave the woods so long as there is any danger of its being shot. Attempts to provide a searchlight arrangement for hunting purposes have, therefore, been watched by sportsmen with unusual interest. Apart from being easy to handle and safe in operation, such an outfit must be of sufficient luminous intensity to insure really sportsmanlike shooting, and to allow the age and sex of the game to be ascertained in advance.

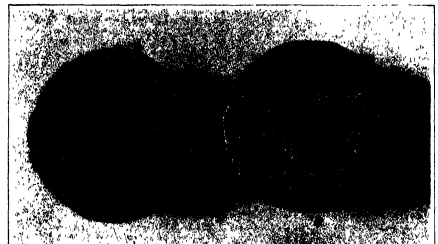
A firm of German constructors, after comprehensive and costly experiments, has succeeded in designing a really convenient shooting searchlight. This is readily mounted on any rifle and allows the back and front sights or the sighting telescope to be used in shooting, as the case may be. The searchlight *projects a bright cone of light on the ground, up to a* distance of 70 meters, or 230 feet, and enables one to take aim at the game in safety, while it is blinded by the light. In fact, it is well known that game struck by the dazzling glare of searchlights remains immovable, as paralyzed, for some time, which accounts for the numbers of animals that are run over by railway trains and motor cars.

In using the new searchlight, as soon as the approach of the game is heard or faintly seen, the rifle is cautiously pointed in the proper direction and the searchlight switched on. Should the game not be the one expected, the source of light is immediately switched out again, lest other game be frightened. In fact, the apparatus will only prove fully useful in the hands of skilled sportsmen; when used at random, it may even do more harm than good. *In the case of pests, such as* rabbits, it may, however, be switched in regularly every 10 minutes or so. The apparatus will render especially valuable services in big game shooting, in the extreme dark of tropical nights, where the dazzling effects are especially striking, so that aim may be taken in perfect safety. Again, the apparatus will prove most valuable in connection with game protection, poachers struck by its light being dazzled and made unable to defend themselves, whereas the ranger sheltered by the darkness of night, may handle his rifle in safety.

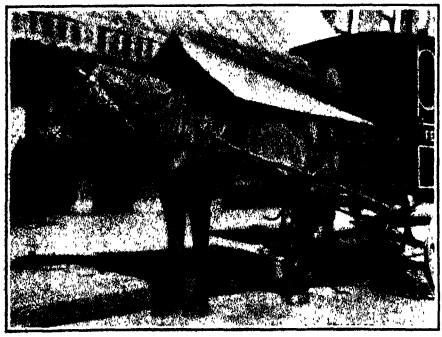
The main advantages of the apparatus may be summed up as follows: The battery and lamp are combined with the optical system in the same steel tube; the light is switched in readily without any special manipulations, and the weight of the outfit is so low as not to inconvenience the shooter in any way. Inasmuch *as many sportsmen have only week-ends at their disposal*, the use of the searchlight rifle will allow every hour of their leisure time to be utilized for their favorite pastime.



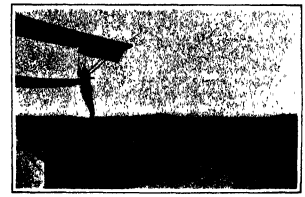
Rifle with searchlight for night shooting.



Hair ball from a cow's stomach, sectioned to show the matted interior.



A sunshade for the working horse.



About to drop on the swaying car.

Cloud Movement Apparatus

AN effective and simple apparatus for observing movements of clouds is the invention of a French meteorologist, M. L. Besson. The nephoscopic "comb" has precisely the form of a magnified rake with the teeth pointing upward instead of at the side, it being made up of a long pole carrying a shorter cross pole at the top, this latter piece having seven upright teeth of about a foot length. A pole resembling a telegraph pole serves to hold the device in the air by means of two brackets, so that the device is held out a foot or two from the telegraph pole and parallel to it, and projects into the air somewhat above it, the base being mounted to rotate on a bracket sheif at the lower end and a short distance from the ground. To make an observation, the experimenter stands at a short distance off, and after sighting the middle point of the comb against the point on the cloud whose movement is to be observed, he pulls on a wrapped cord so as to turn the whole about and place the line of teeth in the direction of the cloud's motion. On the lower base is a card with the compass points so as to note the angle and direction, and the speed of cloud motion is estimated by taking the time needed for the cloud to pass from one tooth to another.

A Parasol for the Horse

TO protect and comfort the faithful horse who works all day long under the broiling sun without a sign of complaint, a tent has now been devised which may be set up on the shafts of a wagon over the body of the horse. The accompanying photograph shows how easily the device can be made. A light framework of steel, clamped to the shafts, holds the shelter in the right position, rigidly above the horse. The covering over the frame is nothing more than a heavy grade of canvas. When once this tent is adjusted it requires no further attention even when hitching the horse, for the latter simply walks under it and is buckled fast in the usual manner. Then the horse proceeds with his work sheltered by the equivalent of a parasol.

Five Year Patent Applications.—The order issued by the Commissioner of Patents, seeking to close up applications for patent which have been pending for five years or longer, has been amended so that it is now ordered that after June 1st, 1914, the examiners will make special every application which has been pending for five years or longer, and every application purporting to be a division or a continuation of an application which has been on file more than five years. Also that after November 30th, 1914, no amendment or other paper presented by or on behalf of applicant in any such application shall be entered without having been first called to the attention of the Commissioner. And that on December 1st, 1914, each Examiner shall report to the Commissioner the applications falling under this order which are pending in his division.

Inventions New and Interesting

Simple Patent Law : Patent Office News : Notes on Trademarks

The Transophone and the Telescribe: Two New Inventions of Thomas A. Edison

By Herbert T. Wade

THE saving of lost time and lost motion is as essential in a modern business office as it is in a mechanical plant, and much of the facility of present-day commercial methods has resulted from various ingenious devices and methods developed to save the time and effort of clerical employees, and to add to their comfort and convenience. Especially is it possible to secure increased facility in the handling of the necessary correspondence of a large office, in the making of records for the executive heads, and in the general administration of the business in hand.

For example, the supplanting of the "blind" typewriter with its hidden sheet, requiring the turning back of the carriage, by the machine with visible writing contributed in no small degree to the speed and accuracy of the preparation of commercial correspondence and records, while the use of the dictating machine, whereby the letters are transcribed from a phonographic record without the agency of a stenographer who has written them in shorthand, has been another step in advance. Recently, as another evidence of progress, there has been perfected by Thomas A. Edison and his engineers an ingenious device, known as the "transophone," which greatly increases not only the efficiency of the dictating machine, but the comfort and convenience of the typists who transcribe from the records.

How the Transophone Works.

The dictating machine or business phonograph is a familiar piece of office apparatus, consisting of a phonograph on whose wax cylinders are recorded, at the convenience of the user, such correspondence and memoranda or other material as he desires later to be transcribed on the typewriter. These spoken records may be made at any time at the convenience of the person concerned, to be collected and given to a typist, who places the cylinders in her dictating machine and adjusts the listening device, which has rubber tubes by which the sound is conveyed to her ears, and then writes on the machine as she hears the spoken words reproduced from the sound box. It is of course possible that a typist may not catch the sound accurately, or may require a repetition of one or more sentences. This was an early defect of the dictating machine, and was remedied in part by providing a lever



Copyright by Thomas A. Edison

Typist pressing the transophone key, which causes the dictating machine to repeat a portion of its record.

for the typist, which could be adjusted so that the recording stylus could be sent back over a certain portion of the record and a repetition made. This, of course, required the operator to turn from her typewriter to operate the lever, causing a loss of time and a certain amount of distraction, as anyone who had given any thought to "motion study" readily might appreciate. In fact, an increase in efficiency of from 10 per cent to 25 per cent is claimed for the operator to which must be added the effect of the reduced strain in transcribing.

Many operators at first were not particularly partial to the dictating machine at best, and it often required some persuasion and training to enable the transcribing to be done efficiently and effectively in an office. While the use of the dictating machine was a considerable advance over the use of note-book and shorthand notes, Mr. Edison realized that the mechanical side of office writing still required considerable improvement, and



Copyright by Thomas A. Edison

Edison listening to a telephone conversation recorded by means of his telescribe.

accordingly, to avoid the former hand repeating of the dictating machine, he has now provided the transophone. In this a dictating machine is controlled electrically from the typewriter keyboard.

A special switch is provided, conveniently placed, and when the operator wishes a few words or a sentence repeated, she merely touches the button or key of the transophone switch, just as she would any key on her board, for, in fact, it is not unlike those corresponding to the various characters. Immediately the dictating machine automatically repeats over the space for which it has been set, giving a convenient number of words, one or a dozen or more. This can be done as often as desired, simply by touching the key, which is an electrical button, using the same essential touch as a typewriter key. This electric button actuates a "quick make-and-break" in a circuit with a magnet on the dictating machine, and when the latter is energized through the passage of the current, its armature is attracted, and a cam mechanism is operated, which lifts the traveling carriage from its screw and thus "back spaces" or moves it back the required distance on the feed screw, so that the repetition is effected as automatically as the operation of the mechanism is noiseless.

Difficulties That Had to Be Overcome.

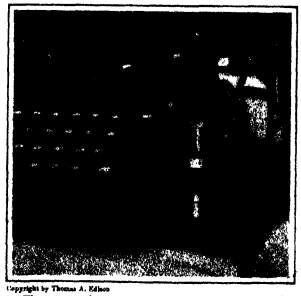
This would seem a simple mechanical undertaking, but its development has been attended with many difficulties. To begin with, the electrical button or switch itself is not the simple matter one might imagine would be secured by merely reproducing the detail of the typewriter key. It must operate on an ordinary 110-volt lighting circuit, but with an almost infinitely small consumption of current costing at a liberal estimate not more than 10 cents a year, and must meet the demand of the insurance officials for a sure and safe acting make-and-break key. Then again, the mechanical operation of the carriage of the dictating machine must be absolutely sure, as the record groove engraved by the stylus is almost microscopic, and the motion must be controlled within narrow limits.

However difficult this has been, it has been successfully accomplished, and one can see the operator at her typewriter using the dictating machine and keeping her eyes on the page she is writing or removing hands from the keyboard, without realizing that very often she is having words repeated for her without the slightest inconvenience or undue loss of time or motion, while the foot pedal enables her to start and stop the reproduction in the usual manner at convenient periods. Then there is a detachable connection.

The new invention unquestionably will act to increase the usefulness of the dictating machine, and at the same time commends itself to operators. It is typical of a class of inventions that may be recorded from time to time, where efficiency is gained by consulting the comfort of the individual employee, or in other words, bringing the mechanical side to bear upon the human element, to secure increased output. Furthermore, it is interesting to record that the transophone attachment may be added to any standard dictating machine by the simple process of replacement of a few parts that would interfere in no way with the essential construction and operation. In this way users of these machines may avail themselves of increased advantages secured by new inventions and improvements.

Recording a Telephone Conversation.

When Mr. Thomas A. Edison first brought out the phonograph, which, it is interesting to recall, received its general introduction to the public through a description in the columns of the SCIENTIFIC AMERICAN in 1877, there were a number of applications and uses that suggested themselves to the mind of the great inventor. Many of these have been achieved from time to time as the development of the phonograph has progressed, but others have encountered various obstacles in the way of their realization. One of the suggested applications that only recently has been brought to a successful outcome has been the use of the phonograph in connection with the recording of a telephone conversation. This has just been accomplished by the new "telescribe" which has been devised by Mr. Edison and his engineers, and is shortly to be placed upon the market in a practical and commercial form. To connect the receiver of a telephone with a phonograph would seem a simple sort of an undertaking, and theoretically presents no special difficulty, but in reducing this idea to practice there have been many obstacles to overcome, and the problem has received much attention from Mr. Edison and his associates for a number of years. Such a machine to be useful must be as sure, simple, and



Copyright by Thomas A. Edison

The transophone switch key, by pressing which the phonograph may be caused to repeat a portion of its record.

practical as the ordinary telephone or typewriter and no less efficient. It must be developed far beyond the range of laboratory practice or mere demonstration, and this has been done in the telescribe, which a representative of the SCIENTIFIC AMERICAN, by special invitation, was recently permitted to see in operation at the Edison Laboratories.

In one of the executive offices of the Edison Labora-

(Concluded on page 218.)

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

DRESS FORM.—L. T. FUERAS, Lima, Ohio. This invention provides a dress form to be worn beneath corset covers, skirts, and other garments with a view to rectify deficiencies in the body of the wearer, and arranged to permit the user to accurately draw up the ruffles after washing the garments with a view to correctly shirr the ruffles to fit the garment.

BANDAGE CORSET.—PAULA KLEIN, 3462 Broadway, New York, N. Y. The object here is to provide an attachment which is applicable to corsets of general construction and designed for use by women after operations and for maternity uses so as to support the lower part of the abdomen and provide for increased comfort by avoiding all downward pressure and relieving and curing symptoms due to relaxed and inefficient abdominal walls.

Pertaining to Aviation.

AEROPLANE FUSELAGE.—A. J. A. DEPEUBOSSIN, 19 Rue des Entrepreneurs, Paris, France. This invention relates to an aeroplane fuselage constituted entirely by the juxtaposition and cohesion, at crossed directions, of very thin slats of small widths of wood, cardboard, paper or the like. The fuselage obtained in this way is endowed with extraordinary rigidity and solidity.

Electrical Devices.

TELEPHONE.—L. S. BOYCE, Rockwell City, Iowa, and O. E. BOYCE, Minn. An object of this improvement is to provide an attachment by means of which a subscriber on a party line can listen and not be heard, but which will permit the subscriber to talk and be heard when a button is pushed.

ELECTRIC FURNACE.—N. TESTRUP, 6 Broad Street Place, London, England, and T. RIGBY, Station Hotel, Dumfries, Scotland. This invention relates to improvements in connection with smelting operations, and more particularly to such operations carried out in an electric smelting furnace and using peat as fuel. The processes are especially applicable to the smelting of iron.

Of Interest to Farmers.

FEED HOPPER.—H. B. MEIER, 222 Madison Ave., Port Chester, N. Y. This invention relates to the care of live stock and has particular reference to devices shown and claimed in Letters Patent of the U. S. for automatic time contact switches, No. 1,092,736, granted to Mr. Meier. The invention has reference to the form and construction of a feed container or hopper with novel means for maintaining its bottom in closed position until the predetermined time for the discharge of the feed.

LOADER.—C. M. WANGERMAN, care of Carl Brekke, Hay, N. D. In this case the invention relates to loaders and more particularly to devices including means for gathering and conveying hay and grain in the field to a wagon, cart or vehicle in connection with which the loader is moved from place to place.

Of General Interest.

POST ANCHOR.—P. T. BAILEY, Melville Station, Newport, R. I. This invention relates to post anchors, and particularly to an improved anchor which may be readily clamped in position at any time, and at any desired point along the post, whereby the post may be set any desired distance in the ground.

CLOTHES POUNDER.—H. L. ALBISSER and J. SIMON, 84 Monroe St., Rahway, N. J. This invention refers to improvements in washing apparatus, and particularly to what is known as a clothes pounder, and has for an object to provide an improved structure which will force or propel water through the clothes being washed.

ANIMAL TRAP.—C. M. C. KIRK, care of Leo M. Harris, South Fort George, British Columbia, Canada. This trap has means to support a resilient clasp, and means whereby the clasp will be automatically released by the animal, to grip the animal. In the preferred form of the invention a series of resilient clasps are slidably suspended on a rod; a retainer holds the clasps in the open position, and a step-by-step release means is controlled by movements of a bait holder.

FENCE WIRE SPLICING.—L. N. SWAFFORD, Kenton, Ohio. This invention provides a joint for connecting the ends of the wires together and the method of making the joint, the advantages being that a joint can be easily and quickly made, and at the same time possesses great strength and resisting power to longitudinal strains on the wire.

CLEANING TUBULAR AND OTHER VESSELS.—T. RIGBY, Station Hotel, Dumfries, Scotland, and N. TESTRUP, 6 Broad Street Place, London, England. This invention pertains to the removal of deposited matter from or the prevention of deposit in vessels employed in the treatment or handling of matters liable to produce deposits. An example of such an apparatus is the apparatus which has been proposed for wet carbonizing peat.

PENCIL.—H. REICHE, Box 785, New York, N. Y. This invention refers to certain improvements in pencils, and more particularly to that type of pencil in which the marking material is contained within an inner chamber or compartment and fed therefrom as required for use.

FIRE EXTINGUISHER.—T. AKESON, care of Thomas W. McKnight, Room 308-309, No. 147 E. 125th St., New York, N. Y. This inventor provides a gas tube having a terminal extending into a mouth of a gas reservoir which is suspended within a casing by springs, the terminal of the gas tube being spaced from the sides of the mouth of the reservoir to permit communication between the reservoir and the interior of the casing. The casing is filled and a gas is then compressed in the reservoir through the gas tube for forcing the fluid from the casing when a valve at the outlet to the casing is opened.

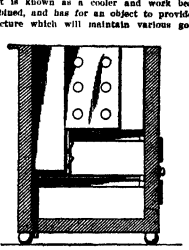
TILE STRUCTURE.—F. THOMAS, 357 E. 156th St., New York, N. Y. This improvement provides efficient, economical and simple means for retaining ceramic and other tile in service position; avoids the use of cement or other plastic material; and forms a backing or register for tile of the character mentioned to permit the removal of the tile from the service position.

Heating and Lighting.

POLE LATCH AND CAVEL.—E. F. JOYCE and W. B. KAIN, Wheeling, West Va. Address W. B. Kain, Supt. City Light Plant, same place. This device is adapted to be attached to the supporting pole of an electric light, for engagement by the flexible suspending member from longitudinal movement both in elevated and in lowered position, and wherein the arrangement is such that the lamp will be supported in either position, and may be easily lifted and held lifted, and without the possibility of being tampered with by unauthorized persons.

Household Utilities.

ICE BOX.—J. W. N. TRIES, 539 W. 50th St., New York, N. Y. This invention relates to refrigerating devices, and particularly to what is known as a cooler and work bench combined, and has for an object to provide a structure which will maintain various goods



ICE BOX.

in a cool condition, and at the same time present a surface of cracked ice for use at all times. Means provide for causing the cracked ice to act as a cooling medium for articles arranged adjacent thereto.

VACUUM CLEANER.—A. R. MARSHALL, American Radiator Co., 104 W. 42nd St., New York, N. Y. An object here is to provide a tool with a plurality of openings which are normally covered by a valve but which may be opened as desired by the operator, to admit a supply of air at the rear of the mouth of the tool, thereby regulating the flow of the air into the mouth of the tool, and permitting the use of the tool for a great variety of purposes, without changing the suction at the pump.

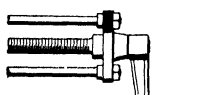
ICE SHAVER.—C. A. HOLT, Chickasha, Okla. The blade being adjusted properly, the receptacle is moved over a block of ice with a planing action, and the slivers or shavings of ice pass into the receptacle. When a sufficient supply is collected, the cover is elevated, and the contents are pushed out at the front. When the cover is closed the coil spring is placed under tension, thus acting normally to retain the cover open, and the plate in its forward position. After the box is filled with ice shavings, merely by releasing one's grasp of the box it is automatically opened by the spring.

Machines and Mechanical Devices.

ROAD MACHINE.—M. M. SICKLER, Palo, Cal. This machine combines the advantages of a road grader and a scraper, and can move the material to side or center of a road and also forward along the line of work making fills, turnouts, and removing unevenness in road surface. The change from one class of work to the other, and the angle of the scraper blade to the line of work, can be made by combined action of draft and steering wheels, or by a manually operated mechanism without stopping the steam, or raising the scraper blade.

MACHINE FOR PRINTING CLOTHING TICKETS.—ALOISE ANTOINE and E. ANTOINE, care of the former, 163 Autumn St., Passaic, N. J. The present invention relates more particularly to the construction and arrangement of type-holders and inking devices therefor, from which the two sets of type with which these machines are provided, are supplied; and more particularly to the construction of certain features of the machine disclosed in patent No. 784,375, formerly granted to the inventors.

DRILL ATTACHMENT.—F. T. COOK, Miami, Okla. In this case the invention provides means for withdrawing a drill from a drill hole in the event of its becoming stuck there-



DRILL ATTACHMENT

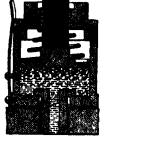
in, and irrespective of the length of the driller or the depth of the hole, with very little trouble or waste of time.

BRAKING DEVICE FOR REVERSIBLE GEAR MECHANISM.—F. J. ROBINSON, 44 W. Tyler St., Hampton, Va. An object here is to provide a braking mechanism for reversing gears in which a spring ring is so disposed with relation to a drum that the ring may be brought into contact with the drum at all points on its periphery when actuated and when free from the drum it may spring entirely away from the drum.

Prime Movers and Their Accessories.

CARBURETER.—W. J. OMER, care of Ever Ready Boiler Scraper Co., Thomas, Okla. The purpose here is to provide a device adapted for use with internal combustion engines of every character, wherein mechanism is provided for thoroughly volatilizing gasoline or other liquid fuel, and for mixing the volatilized fuel with air to provide for perfect combustion of the fuel.

GREASE CUP.—R. M. MCGROVE and F. R. HOWARD, 144 W. First St., South Salt Lake City, Utah. This invention relates to grease cups having a spring-pressed piston to force the grease from the cup to the member to be lubricated. It is applicable to the rotary parts of locomotives, stationary and traction engines, and other machinery. It resides in cer-



GREASE CUP.

tain features relating to the piston and piston rod, whereby to limit the forward movement of the piston under the action of the spring, so as to limit the total feed of the piston to any desired extent, the adjusting means being capable of holding the piston in retracted position against the movement of the spring, thereby cutting out the automatic feed feature.

SHORT-CIRCUITING ATTACHMENT FOR GAS-ENGINE IGNITERS.—C. M. WEEKS and H. N. JACKSON, Babylon, N. Y. This invention refers to means for grounding igniters by means of which the charges are exploded in the cylinders of multi-cylinder internal combustion engines, for the purpose of determining whether or not any of the cylinders are failing to work, and which particular cylinder with the igniter therein is defective in operation or entirely out of commission, owing to the fouling or short-circuiting of the spark-points inside of the combustion chamber, or from any other cause.

Railways and Their Accessories.

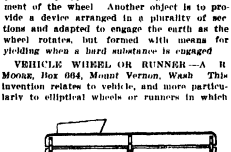
PORTABLE DERAILING DEVICE.—W. P. NEWKIRK, 509 Sixth St., Portsmouth, Ohio. This device is especially adapted for use in connection with car inspectors' and repairers' blue flags, is capable of being easily transported, adapted to be connected to a rail at any desired point, and has means for checking and derailing a car at any predetermined point to protect car repairs, inspectors, or track ends, and has means for supporting a flag or other signal.

Pertaining to Vehicles.

FIFTH WHEEL.—E. S. HALL, Bellfry, Mont. Mr. Hall's invention provides a fifth wheel which will relieve the king bolt from undue strain, and which will give great stability and firmness between the wagon parts, when a wagon with his improvement is used on uneven roads, or when the load is very heavy.

NON SKIDDING ATTACHMENT FOR AUTOMOBILE WHEELS.—D. J. PENNO, 420 Commercial St., Trinidad, Colo. The object in view is to provide a structure readily attached and removed, but when in place to positively prevent any appreciable skidding or side movement of the wheel. Another object is to provide a device arranged in a plurality of sections and adapted to engage the earth as the wheel rotates, but formed with means for yielding when a hard substance is engaged.

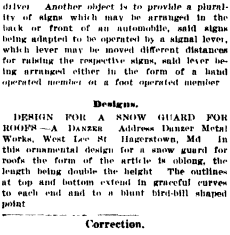
VEHICLE WHEEL OR RUNNER.—A. R. MOORE, Box 604, Mount Vernon, Wash. This invention relates to vehicle, and more particularly to elliptical wheels or runners in which



VEHICLE WHEEL OR RUNNER.

the tread consists of an endless element which travels around the inner frame or fixed section of the runner. The invention improves the construction of traction devices of the character referred to so as to be of durable and substantial design, capable of operating with a minimum of friction, and at the same time providing resiliency, so that easy and smooth running of the vehicle is insured.

AUTOMOBILE SIGNAL DEVICE.—FATHER R. D'ANTONIO, 157 Thompson St., New York, N. Y. An object here is to provide a structure for shifting a plurality of signs, said signs being arranged either in the front or rear of an automobile so as to indicate to an adjacent automobile or vehicle the intention of the



AUTOMOBILE SIGNAL DEVICE.

driver. Another object is to provide a plurality of signs which may be arranged in the back or front of an automobile, said signs being adapted to be operated by a signal lever, which lever may be moved different distances for raising the respective signs, said lever being arranged either in the form of a band operated member or a foot operated member.

Designs.

DESIGN FOR A SNOW GUARD FOR ROOFS.—A. DANZER. Address Danzer Metal Works, West Lee St., Hagerstown, Md. In this ornamental design for a snow guard for roofs the form of the article is oblong, the length being double the height. The outlines at top and bottom extend in graceful curves to each end and to a blunt bird-bill shaped point.

Correction.

In the SCIENTIFIC AMERICAN of August 15th is a notice of a patent for cross tie to George F. Brockway whose address in the notice should read *Wauconia, Iowa*, instead of Eden Iowa.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Inquiry No. 9285. Wanted the names and addresses of manufacturers of machinery used for perforating music rolls for automatic pianos

Inquiry No. 9286. Wanted a device to prevent eavesdropping on party telephone line

Inquiry No. 9287. Wanted the name and address of manufacturer of coupling for connecting refrigerator cars that will stand pressure while wear and tear and for extreme wet or a climate hot tropical climate

Inquiry No. 9288. Wanted the name and addresses of manufacturers of a shoe board which is absolutely smooth on both sides, but subject to warping and free from any imperfection, or ridges or small irregularities. Board should come to about 5 ft. wide by 5½ ft. long and run from ⅛ of an inch in thickness, and must be reasonably economical. A board of this description, or exactly what was required, only the expense is too prohibitive to make its use practical

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Inquiry No. 9291. Wanted, the name and address of makers of agents for the utilization of by-products from sawdust, also waste wood.

Combining the Phonograph and the Camera

(Concluded from page 208.)

axis of the commutator, which is divided into six separate parts, this being for the purpose of forming a make-and-break circuit. From the commutator the electrical current passes by cable, which may be of any desired length, to the projecting machine or camera. For illustration, we will employ the projector. From this cable the current passes to a solenoid motor, consisting of six oscillating electromagnets, each of which is equipped with an armature or plunger. These magnets are cylindrical in form and their bottoms are especially wired. The upper ends of these plungers are connected to a horizontal crankshaft, which in turn is connected with a mechanism that turns the projector by means of bevel gears.

Each of the magnets of this motor is connected to one of the sections of the commutator, so that when a section of the commutator is pressed upon by the contact brushes its corresponding magnet is compelled to do the work for which it is intended, this being to draw its respective plunger to the bottom of the magnet. As the commutator is turned around these magnets are energized one after another, and in this manner they turn the crankshaft, which is a six-throw affair. The faster the commutator revolves, the faster is this solenoid motor compelled to work, the speed at which the projecting machine runs being in strict accord. It will be seen that it is impossible for these machines to go at different speeds. The speed of the phonograph regulates the commutator, which in turn controls the electric motor which propels the projector. The operation is very simple when understood.

The very same operation is used when the pictures are being taken and the record is being made. The unexposed film is placed in the camera and the blank record is put upon the phonograph. Before the machines are started the points of starting are marked so as to be easily found when it is desired to employ the reproducing process. The phonograph is started, this propelling the commutator, and this in like manner governing the speed of the motor or set of magnets by which the motion picture camera is propelled. The machines may be stopped and started at any point or points, operation to be resumed later by simply starting the phonograph, and this without the loss of synchronism. The motor used to run the camera is not so large as the one by which the projector is propelled. In fact, the camera motor is so small that it may readily be carried from place to place in a hand case. Each of the projector magnets is about four inches in diameter and ten inches in length. As it is now possible to make phonograph records with the performer standing at any distance up to thirty feet from the recorder, the combining of these two instruments for the production of all ordinary scenes or plays is extremely practical.

Moving Picture Panoramas

(Concluded from page 208.)

of a large circular hall, so as to cover simultaneously the whole of its circumference In an ordinary kinematograph, films are, of course, projected by an intermittently operating mechanism, each section being successively illuminated, projected, and advanced in one sixteenth of a second. The projection of moving-picture panorama films is by no means more difficult, provided the camera described be supplemented by some illuminating means.

In order to facilitate the understanding of the underlying principle, let the film be supposed to be lighted intensely by a lamp within a lantern projecting on the screen a narrow picture, in accordance with the width of the slot *d*.

Suppose the apparatus, installed in a circular hall with white walls, to be set rotating slowly? Narrow pictures, corresponding with each point of the original scene, will appear successively at the various parts of the circumference. If a

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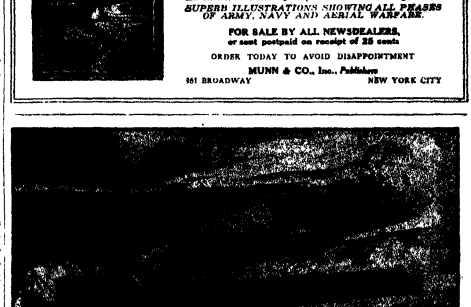
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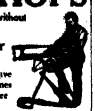
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tree was standing on one side of the scenery, in taking the kinematograph record, and a house on the other side, the tree will be projected *in succession* on opposite sides of the hall. Owing, however, to the persistence of visual impressions, the human eye will perceive simultaneously successive parts of the picture, provided the apparatus be turned round at a sufficient speed. In fact, the narrow bands composing the projection will melt into a single continuous picture covering the whole circumference of the hall like a real panorama. A similar principle has been embodied in the "photorama" designed by the Lumière Brothers, where rotating objectives were arranged to project a photograph wound on a glass drum.

In actual practice, it is, of course, impracticable to arrange the lamp immediately behind the film. A powerful searchlight is therefore installed outside of the apparatus, the light of which is thrown by mirrors through the hollow axis of rotation.

The astonishing result obtained by Dr. Goetz's apparatus may be described as follows: The Lumière "photorama" at each rotation projects an always identical picture, the picture passing before the slot of this apparatus is seen to vary continually, each turn bringing a new phase of the original motion into view. In fact, the projection thus obtained is a real moving-picture panorama, performing its natural movements, where houses and other immovable objects, of course, remain in position, the same as on an ordinary kinematograph film. The apparatus, it is true, requires an intense illumination; since, however, the insertion of a glass trough containing an acidulated 1 per cent solution of copper sulphite eliminates heat effects to 90 per cent nearly, this does not entail any danger

Moving-picture panoramas literally place the spectator in the midst of a given event or scenery. He sees himself transferred to the center of traffic in a city where vehicles and pedestrians converge from all sides, to aerodromes, where airships and aeroplanes unceasingly perform their maneuvers, to horse, bicycle, and automobile races, football matches and other sporting events, processions, popular festivals, expositions, etc. He is afforded an opportunity of watching from the "Officers' Hill" the strategic operations of armies, and from the conning tower of a battleship the maneuvers of a fleet. He is able, in the moving-picture theater, to fancy himself aboard a steamer or in an open carriage, traversing the most fascinating scenery.

Panorama films may as well be cut into sections and projected intermittently on a plain screen, like ordinary kinematograph pictures.

The Transophone and the Telescribe

(*Concluded from page 216.*)

tories the writer was received by a representative of the general manager, who immediately proceeded to call up on the telephone the engineer in charge of this new and interesting instrument. He was asked if he would be able to make a demonstration of the machine, explaining that a description of it would interest the readers of the SCIENTIFIC AMERICAN. Accordingly an introduction of the author was made over the telephone, who explained his general wish to see the new instrument in operation. A few minutes later the experimental laboratory was reached, and sitting down in front of the telescribe, having in his ears the tubes of what seemed an ordinary Edison dictating machine, with a few simple extra adjuncts, and a small metal box on the desk before him, he was able to listen to a repetition of the previous telephone conversation which had been recorded on a wax cylinder. The voices of the three individuals participating in the conversation came out clearly and distinctly, and, further, it was possible to repeat at will any desired elements of the conversation.

The Field of the Telescribe.

The possibilities of the uses of the instrument at once suggested themselves. The first was the record of commercial transactions, many of which are made over the telephone by word of mouth, and may be subject to lapses of memory and misconceptions or misunderstandings. Furthermore, the recording of significant information as in a lawsuit, where an attorney may be informed as to what a witness will testify, and desires a more accurate record than could be obtained from memory, or, even if it were feasible to arrange for it, or from the record of a stenographer listening at a receiver on the same telephone circuit. Again, the transmission of late advertising copy by telephone, where the exact words must be secure, is beyond question another example. In fact, the possibilities of the new instrument seemed almost endless, and its perfection in commercial form seemed to suggest its availability for wide use.

The telescribe, like many other important inventions that have required years for their development and perfection, when examined, seems of the simplest character. No change is made in the ordinary telephone equipment, as there is no electrical or mechanical connection to the line. The person at the telephone wishing to record a conversation takes down the receiver as usual, and when he desires to have a phonographic record made, he simply places it (the receiver), with the diaphragm end downward, on a leather-cushioned spring socket, where it is snapped into a holder.

At the same time he picks up a watch-case receiver, forming a part of the telescribe, or extra telephone circuit, which he holds to his ear. Placing the ordinary receiver on the spring socket of the telescribe automatically switches that apparatus into operation, and from the time that the central operator is called and the connection established a complete record of the conversation may be made, including, of course, words spoken into the transmitter as well as those heard at the receiver.

Any sound resulting from the movement of the diaphragm of the main telephone receiver is communicated to a specially sensitive transmitter, placed in the metal box which houses the essential features of the apparatus, including a dry battery for the transmitter and a special pneumatic switch for operating the dictating machine. For it may not be necessary to record the entire conversation, only its essential parts, and the wax cylinder is started and stopped at the control of the listener simply by pressing two small buttons. The dictating machine is of the usual Edison type with a few important and special adjuncts, and it is interesting to observe here that in this, as practically in all the Edison apparatus, improvements and extensions can be made to the older types of apparatus by simple adjustments or substitutions and additions of new and essential elements. Here, in addition to the listening and recording features of the usual phonograph, there is a telephone receiver of special design, whose diaphragm vibrates in unison with the diaphragm of the sensitive transmitter in the metal box of the telescribe

Directly below this telephone receiver, but not in mechanical connection, is the ordinary sound-recording diaphragm with its stylus, so that when the telephone receiver is in operation the diaphragm of the former vibrates in harmony with the action of the sound waves sent out from the metal disk, and the stylus cuts its groove of varying depth upon the wax of the revolving cylinder. This special telephone receiver, which forms an independent circuit from the telescribe transmitter with wires connecting with the metal box on the table, where the ordinary receiver is placed, is arranged so that it may be swiveled into place over the recorder of the dictating machine, whose ordinary operation and functions are in no way diminished or impaired when not in use for recording the conversation.

With the telescribe and dictating machine, therefore, an ordinary cylinder record or telescript can be made which can be filed for reference or evidence, repeated as often as desired, or transcribed if necessary, so that it is more than an "eavesdropper" on the telephone line.

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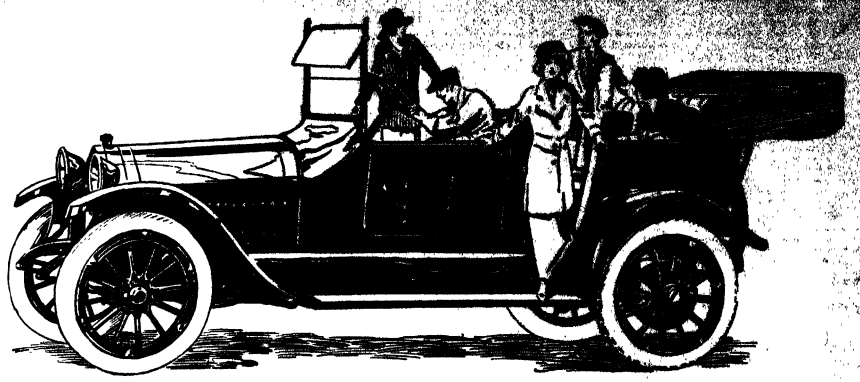
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PREPARED Asbestos Fibre for Manufacturers use
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OFFICE, ST. PAUL BUILDING
220 Broadway, New York



The Studebaker Car is an Impressive Example of What Honesty of Purpose, Square Dealing and Good Manufacturing Can Accomplish in Sixty-two Years

Our fathers and grandfathers knew the name Studebaker.

For sixty-two years it has meant American vehicles honestly and sturdily built.

For sixty-two years farm and city homes have known Studebaker as the name for dollar-for-dollar value.

These sixty-two years Studebaker has grown enormously, in reputation, in production, in prosperity.

The little country blacksmith shop of the early fifties has developed into what we believe to be the largest, best equipped automobile plant in the world.

The production has grown to more than 1000 motor cars every week in the year.

But during all these years of development the original Studebaker ideal of manufacturing honest goods and selling them at honest prices has remained unchanged.

Today Studebaker means, in city and country, the acme of comfort and elegance—as well as the acme of money-worth.

Undoubtedly—along with the whole country you have been amazed at the prices for the new Studebaker cars.

$985 for a big roomy five-passenger "Four" and $1385 for a Studebaker "Six" are extraordinary prices.

They would be extraordinary prices for just a "good" car.

They are truly amazing prices when they carry with them the Studebaker name—the Studebaker Reputation—Studebaker Quality and the Studebaker Guarantee.

Yet they are thoroughly sound, conservative, safe prices—safe for the manufacturer—safe for the buyer.

And they have been made possible for these reasons—

First—there is the huge volume of Studebaker production.

More than 55,000 Studebaker cars manufactured and sold during the last eighteen months—with a schedule for the present year calling for a minimum of 1000 a week—

Second—Studebaker cars are manufactured complete in Studebaker plants.

Studebaker motors, springs, bodies, tops, drop forgings are all made in Studebaker plants.

Special formulæ for Studebaker steels are worked out, and the steels are analyzed and tested in Studebaker laboratories.

Studebaker gears, axles, transmissions are all manufactured and heat treated in Studebaker plants.

And this completeness of Studebaker manufacture means not only better, stronger, longer lasting cars—

But in addition it means the saving of the parts-maker's profit—

The Studebaker Corporation divides its profits not with parts-makers—but with the buyers of Studebaker cars.

That is why Studebaker prices are full $500 less than you would expect to pay for Studebaker quality.

The Studebaker Automobile Book is a Wonderfully Interesting and Instructive Volume—Write for It

Studebaker Prices

FOUR Roadster	$ 985
FOUR Touring Car	985
SIX 5-Passenger	1385
SIX 7-Passenger	1450

F. O. B. Detroit

Studebaker

DETROIT

Canadian Plant, Walkerville, Ont.

Applying to All Studebaker Cars

Full floating rear axle with Timken bearings—Electric starting and lighting—Extra size tires—Safety tread in the rear—Built-in wind shield—"One-man" type silk mohair top—Crown fenders.

16. NOV. 1914

SCIENTIFIC AMERICAN



GERMAN MILITARY PARSEVALS PASSING THE COLOGNE CATHEDRAL

How Great Britain Trains Her Military Aviators

An Automobile Military Wireless Station

Time as a Factor in Baseball

Vol. CXI. No. 12
September 19, 1914

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents
$3.00 A Year

HUDSON Six-40 1915 Model $1,550 This Year F.O.B. Detroit



Howard E. Coffin
Chief of the 48 Hudson Engineers

The Final Authority

On New-Day Quality Cars

The new HUDSON Six-40—like all former Hudsons—is a Howard E. Coffin creation. So were cars before Hudsons—cars which marked some of the greatest steps in motor car progression.

Legions of men who have owned these cars regard Mr. Coffin as final authority in this line of engineering. So do legions of others who have watched motor car evolution.

Do *you* know another designer who has accomplished so much, or has led in so many advances?

Go See His Ideal Six

The HUDSON Six-40 for 1915 is the finished model of Mr. Coffin's ideal car. It shows his final conception of the new-day type.

He has worked for four years on it. So have 47 other HUDSON engineers. Thus this HUDSON Six-40 is their composite idea of the modern high-grade car. It is their latest and best, in big things and little—in beauty and in mechanism, in equipment and detail.

If there are faults or shortcomings—if any car excels it—then these 48 engineers are mistaken. But that isn't thinkable. You will find in this HUDSON Six-40 the representative car of today.

It Differs in Degree

The HUDSON Six-40 is not unique. It is simply in advance of others in the almost universal trends.

Practically all of the upper-class cars are now Sixes. And that designer is rare who doesn't consider the Six as his final goal. It meets his ultimate object—continuous power.

Lightness is a common trend. The old excesses—due to wrong materials or crude designing—are being rapidly wiped out. The HUDSON engineers—in this 2,890-pound car—have merely excelled their rivals.

Low operative cost is sought for by makers and users alike. But the HUDSON Six-40 saves more than others, by record lightness in this class and by a new-type motor.

All aim at beauty, comfort and attractions in equipment. But 48 designers have worked four years in perfecting the HUDSON refinements.

And the price trend is generally lower. Larger production and standardization make this expected and possible. But the new HUDSON Six-40—selling $200 lower than last year—best shows what efficiency can do.

Five Bodies—No Delays

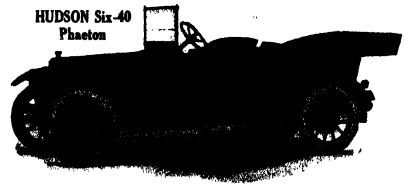
The HUDSON Six-40 is built this year with five beautiful new-style bodies. Note the list below. Each offers countless up-to-date attractions, some of which are exclusive to this car.

With our trebled output this year we are coping with demand. We go to extremes to save delays to our buyers. Up to this writing, 45 per cent of all this season's shipments have gone out by express—trainloads to single cities.

Today you can get prompt delivery, despite this car's amazing popularity. Go see your HUDSON dealer. If he cannot deliver a car at once, he will see that you don't wait long.

Hudson dealers everywhere. Catalog on request.
7-passenger Phaeton, $1,550, f. o. b. Detroit.
3-passenger Roadster, same price.
Cabriolet, $1,750—Coupe, $2,150—Limousine, $2,550.
Canadian Prices: Phaeton and Roadster, $2,100 f. o. b. Detroit, duty paid.

HUDSON Six-40 Phaeton



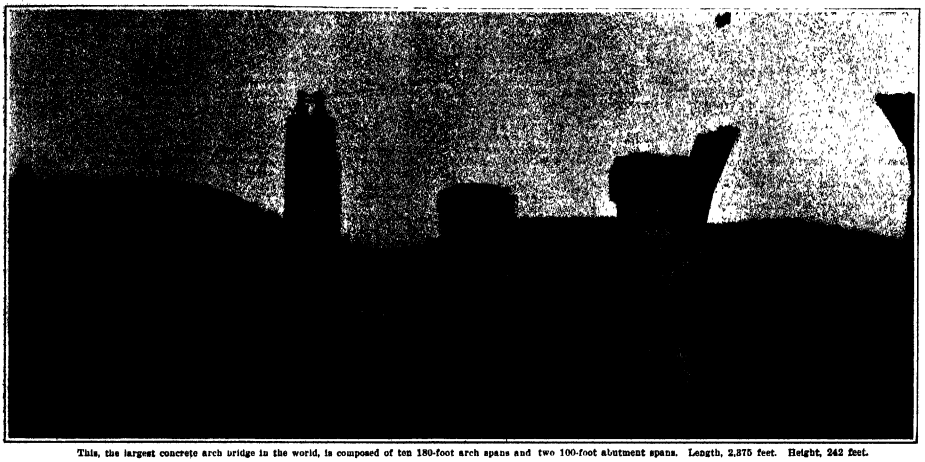
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SEVENTIETH YEAR

SCIENTIFIC AMERICAN

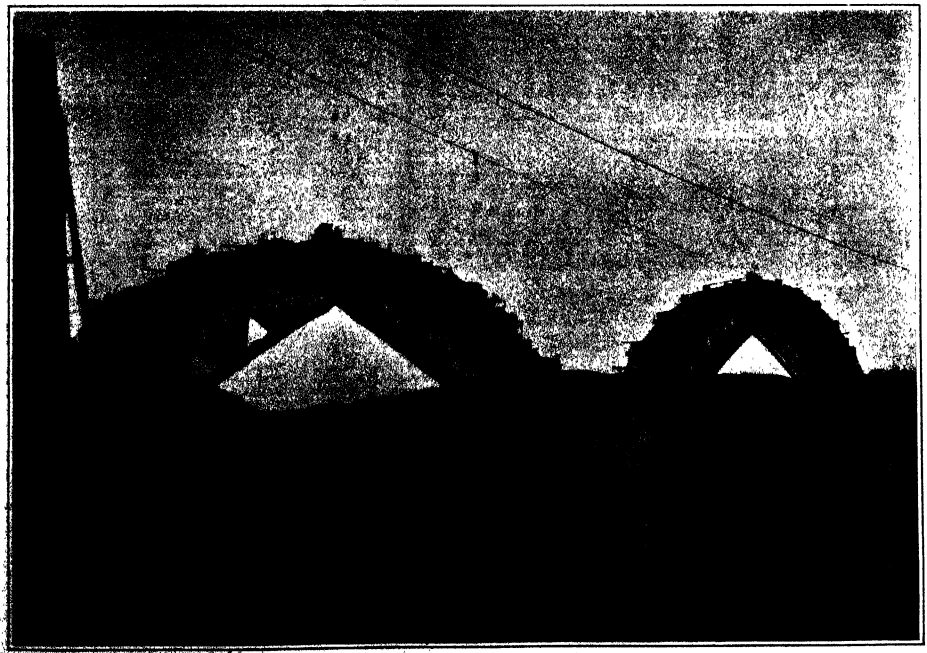
THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXI. No. 12.] NEW YORK, SEPTEMBER 19, 1914 [10 CENTS A COPY $3.00 A YEAR



This, the largest concrete arch bridge in the world, is composed of ten 180-foot arch spans and two 100-foot abutment spans. Length, 2,875 feet. Height, 242 feet.

Constructing the piers of the Tunkhannock Creek Viaduct.



The arch in the left is completed, ready for the superstructure, the falsework being still in place. To the right is seen the steel falsework and forms for the adjoining arch.

Construction of the Tunkhannock Creek Viaduct.—[See page 234.]

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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Illegal Mining and Bomb-dropping

WAR, in spite of the fact that it is the supreme exhibition of brute force, has its ethical rules of conduct, and the frightful game will be played fairly or foully, according to the humanity and sense of honor of the nations engaged.

It has been the constant aim of philanthropy to prevent war, altogether, or, failing that, to mitigate its savagery, and to shield the non-combatant civilian, so far as may be, from its horrors.

There has grown up, through the centuries, a code of practices and prohibitions designed to protect the non-combatant, which of late years has been revised and amplified by The Hague convention.

Long before this convention was drawn up, it had been agreed among the civilized nations that the attack of artillery upon fortified cities should be confined, as far as possible, to the engirdling fortifications, the trenches, camps, and other military elements of the defense, and that the thickly populated city itself should be spared. If military necessity called for the bombardment of the city, it has been customary among civilized nations to give notice of the fact, so as to afford time for the withdrawal of the civilian population.

The wave of indignation which swept around the world, when it was learned that a Zeppelin airship had stolen by night across the sleeping city of Antwerp and dropped high-explosive shells upon its civilian population, was a protest against a revival of the methods of war of the middle ages. Had the shells been aimed at one of the outlying or interior fortifications, or at the barracks, or the camp of the Belgian troops, so far from execrating, the world would have applauded the feat as one of aeronautical skill and daring, and as giving additional evidence of the military usefulness of the airship. But to kill in their sleep the unarmed citizens of a state whose only cause of offense was that it objected to its domain being turned into a cockpit in which its neighbors could settle their quarrels, is to add a spice of vicious ferocity to the attitude of Germany toward a weak and unoffending people.

As upon the land, so upon the sea has Germany seen fit to ignore those rules of The Hague convention, which Germany signed, and which seek to mitigate the cruelties of war, so far as they affect the non-combatants both of the enemy and of neutral states. The Antwerp bombs find their counterpart in the mine-strewn waters of the North Sea—one of the most crowded thoroughfares of the peaceful commerce of the world.

The strewing of mines over the course followed by the enemy during an engagement, or the planting of mine fields for the protection of a country's own channels, harbors, ports, and dockyards, is recognized as a perfectly justifiable means of attack and defense.

This was done on both sides with deadly effect during the Russo-Japanese war. But during that war, and for many months afterward, the floating mines which had been dropped by the Russians and Japanese remained afloat, and drifting in the ocean currents, caused the destruction of many merchant vessels, often at great distances from the point at which the mines were first planted or dropped overboard.

The Hague convention attempted to remove this menace to the shipping of the world by rendering it obligatory so to arrange the mechanism of the mines that they would become ineffective after a certain period of time had passed.

This merciful provision Germany apparently has seen fit to ignore. She has sent her mine-ships out and has strewn the North Sea with mines, which, drifting far and wide, have caused the loss of a large number of the merchant ships, not merely of the enemy, but of neutral states. On the chance of sinking one warship of the enemy, Germany is willing to sink half a dozen unoffending merchant ships of the few maritime states with which she has no quarrel.

That she is willing to incur this responsibility is characteristic of the spirit in which she is conducting her naval and military operations. Every ship flying the American flag that may have to enter the area of naval operations is liable to disablement or complete loss.

Never in all the history of the nations did a great people stand in such sore need of the friendly attitude of the outside world as does the Germany of to-day. That she realizes this is shown by the strenuous effort she is making through the press and by the mouth of her accredited representatives of high standing, to set herself right in the eyes of the people of the United States.

But what would be the effect upon this country if the news was flashed over the wires that the United States ship "Tennessee," let us say, in the performance of her errand of mercy, had struck a floating mine upon the high seas and gone to the bottom?

An Internationalized Science

PERHAPS because meteorology is essentially world-wide in its outlook, and depends to a much greater degree than most other sciences upon international co-operation, it has developed a formal international organization of exceptional strength and authority. Even in this age of scientific solidarity, which has produced the International Association of Academies, the International Institute of Agriculture, and the International Catalogue of Scientific Literature, the International Meteorological Organization deserves special recognition as an example of concerted effort between workers of diverse lands and tongues, the more particularly because it has no political backing to give force to its decisions. The participants in international meteorological meetings are not accredited representatives of governments, and the meetings are therefore unofficial. Nevertheless, the intellectual supremacy of the organization is so fully recognized by meteorologists throughout the world that this body has almost the character of a world-parliament; a character that it could never have assumed if its deliberations were not limited strictly to practical questions. The organization is not a sacred college, prescribing to meteorologists what they shall believe. It concerns itself with methods of observation, instruments, units, definitions, symbols, weather telegraphy, storm signals, and all questions of organization and co-operation. The definite direction of research is attempted only to a limited extent, and then through special commissions of recognized experts who would, even without formal organization, be the leaders in their several lines of investigation.

International organization in meteorology may be said to date from the latter part of the eighteenth century, when the Meteorological Society of the Palatinate, with its headquarters at Mannheim, Germany, established a system of observations on a uniform plan at stations all over Europe, as well as at one in America, and published the results in its Ephemerides (1781-1792). The first assemblage of meteorologists from the leading countries of the world to discuss methods, apparatus, and the like, was, however, the International Maritime Conference held at Brussels, in 1853, "for devising an uniform system of meteorological observations at sea." This conference was held at the invitation of the United States Government, and its leading spirit was Lieut. Maury.

The existing international organization traces its origin to a meteorological conference held at Leipzig, in 1872, at the suggestion of Drs. Bruhns, Wild, and Jelinek. This was convoked unofficially, and was regarded mainly as a preliminary to the First International Meteorological Congress held the following year at Vienna. In its Vienna congress, as well as in the second congress, held at Rome in 1879, meteorology followed the plan which is still customary in other sciences of inviting the various governments, through diplomatic channels, to send regularly accredited delegates to the meeting, the expectation being that greater authority would thus be attached to the decisions reached than could be attained by any unofficial body. This plan was, however, found to be attended by certain disadvantages, the most serious of which was that [illegible] meteorology. Very valuable [illegible] less, at both congresses. At the Vienna [illegible] permanent international committee [illegible] this held meetings in 1874, 1878, and 1879. [illegible] national Meteorological Committee in its present form was appointed at the Rome congress. It has, in recent years, consisted of seventeen members, all of whom are directors of national meteorological services, and it meets about every three years.

Since 1879, instead of official congresses of meteorology, there have been held private conferences of meteorologists who are at the head of meteorological services, whether national or otherwise, viz., in 1891, 1896, and 1905. The next one will be held in 1915, in case political affairs in Europe shall have become sufficiently tranquil. The international committee holds its mandate from the conference last held, and is reappointed at the next one. Its relation to the conference is analogous to that which a board of directors holds to the whole body of stockholders in a commercial organization.

Lastly, the conferences and the committee from time to time appoint "commissions" to organize and direct research in special branches of meteorology. The membership of these commissions is not limited to directors. Commissions now exist on terrestrial magnetism, scientific aeronautics (i. e., aerology), radiation, solar investigations, weather telegraphy, maritime meteorology and storm warnings, and agricultural meteorology.

It should be noted that there have been a few international congresses of meteorology which had no connection with the permanent organization above described. One of these was held at Chicago in 1893, and another at Paris in 1900. It was intended to hold an open congress of this character at Venice this autumn.

The Right Time to Eat

THAT we eat at exactly the wrong time, at least in some countries, is the somewhat remarkable conclusion which Prof. Bergonié of the Bordeaux University reaches as the result of his researches, and this is very apropos at this time when we have the Taylor system of best use of the human motor. Again, in an electric station, the engineers regulate the coal consumption so as to concord with the variable demand for current. But human beings, according to him, although they work at stated hours, carry out the absorption of food quite by chance and without being occupied with making the food supply concord with the periods of most work. Fortunately, the liver acts as a reserve of energy, owing to its glycogenic function, but its capacity is, of course, limited. Take, as an example, a repast composed of 1 part fatty elements, 1 part of proteids (meat), and 4 to 5 parts carbohydrates (sugar, starch, etc.); the utilization of the energy commences almost at once, and the amount of energy available increases up to some three hours after absorbing the food, then it decreases slowly. According to this, it follows that most Europeans and Americans use exactly the wrong hours for taking their repast, that is, from 12 to 1 o'clock and from 7 to 8, for the early morning breakfasts (coffee, etc.) can hardly be counted. Especially to be remarked is that the evening meal acts to produce energy just when the organism is about to rest for a long period, and this can only act to overload the liver, being unused for a long time. According to Prof. Bergonié, the principal repast should be taken at 7:30 A. M., and should be completed by two others, of lighter nature, taken at 4:30 and at 8 o'clock P. M. We would remark that in France and some other countries an early morning repast would not be practicable on account of an absolute lack of appetite for heavy food which is felt at that time, at least by a great number of persons. The Romans had the same habit, so that this must be due to the effect of climate, as it does not depend upon the race of the person who may at any time inhabit such countries.

How to Use the Scientific American's War Maps

THE war maps which were published in the September War Number of the SCIENTIFIC AMERICAN should prove of great value in studying the present conflict from day to day if they are properly used. We have found that if they are pasted upon stout cardboard, the positions of the contending armies can be very clearly indicated by means of pins with different colored heads. As soon as trustworthy reports of movements are received, it is an easy matter to stick the proper pins to the new positions which the armies that they represent occupy. Then one obtains at a glance some idea of the extent of the battle front in the present conflict as well as of the strategic importance of the positions held by each force.

Electricity

Electricity for the Household in Venezuela.—The electric power company which has been supplying the city of Caracas, Venezuela, with electric light, has recently installed day service, and hopes to educate the people to the use of electric stoves, irons, fans, etc. Electric heat and power are ideal for tropical countries. It may take some time to educate the Venezuelans to its advantages, but eventually it should prove indispensable.

Copper and the War.—For the last five years the consumption of copper in this country has been from 63 to 67 per cent of that produced by the mines of the United States. Fifty per cent of the copper refined in this country has been exported largely to countries that are now at war. Evidently then the present turmoil in Europe will have a material effect upon the copper production in this country which will make itself felt in the electrical industries, which are the principal users of this metal.

Electric Heating for Bakers' Ovens.—A recent use of electricity relates to heating of bakers' ovens, and the process is coming into favor as a clean and economical one. Some of the leading electrical works are making this class of apparatus on an improved design. Such plants are adapted also for use on shipboard, and here they are still more to be recommended. In some countries the vessels have been using electric heating for ovens for some time past, and experience shows that it is very well adapted for the purpose.

Street Car Tires of Rubber.—In order to reduce the noise of street cars, and particularly the flat wheel nuisance, it was suggested at a recent meeting of the Tramways Association, in Newcastle, England, that street cars be provided with tires of rubber. It was argued that the wear on the rails would be much reduced, and the life of the rubber tire would exceed that on motor trucks and buses, which are credited with an average life of twenty thousand miles. It was also argued that a higher rate of speed would be possible with the flexible tire

Lisbon's Time Signals.—Correct time is announced every even hour in the port of Lisbon, Portugal, by means of two lanterns placed on iron columns 100 feet high. The lanterns each have three faces, measuring 6.5 feet by 8 feet. At exactly five minutes before the hour, a horizontal line of light appears on each face, and on the tick of the hour, this light is extinguished. The signals may be seen even in the day-time at a distance of a mile and a half. At night the position of the lanterns is indicated by three red lights. The signals are worked electrically under the control of a clock in the Observatorio Astronomico de Lisboa

Electrical Exports and the War.—A recent issue of the *Electrical World* contains tables showing the value of American electrical exports from July 1st, 1912, to June 30th, 1913, for countries now at war, and those not at war. They show that exports for countries now at war were somewhat more than $2,225,000 worth, in other words, one tenth of our total electrical export trade. The other nine tenths went either to ports that are at present neutral, or to the colonies of countries now at war. Because they are cut off from other sources of supply, these colonies and neutral countries should demand a much larger share of our trade.

Electrical Safety Rules.—The Bureau of Standards has been making a study of safety rules and practices in the construction, installation and maintenance of electrical equipment, and has found that such companies as do have safety rules have based them on limited and inadequate experiences, while many companies have no rules because of the expense and difficulty of preparing them and because they are not compelled to take precautionary measures by the State authorities. Accordingly the Bureau has prepared a set of rules based on a thorough study, with the aid and advice of State commissions, companies employing electrical equipment, and workmen. The rules are published in Circular No 49.

Incandescent Lamps for Railroad Lighting.—The new metal filament lamps of high candle-power are likely to take the place of arc lamps for outside lighting in many cases, and one of these is for the lighting of railroad yards. A good example is a large freight station and yard on the Continent which was newly installed last fall. Current at 6,000 volts comes from an outside electric plant into a transformer house where it is reduced to 200 volts. For the lighting which is needed for loading and unloading of freight there are used 24 ironwork poles, each 26 feet high and carrying a 300 candle-power metal filament lamp, while the lighting of the outer tracks comprises 14 similar poles 40 feet high with the same lamps. In other places, 50 candle-power lamps are employed. A suitable device allows of lowering the lamps from the poles when they are burned out, but ordinarily they require no trimming as in the case of arc lamps. A small winch and steel cable lowers the lamp in about the same way as on arc lamp, so that a new lamp can be readily put in. For use inside of freight cars, sets of hand lamps on flexible cables are used, the cables working by trolley wires stretched alongside the tracks.

Science

Nebular Motion.—Recently Dr. Slipher, of the Lowell Observatory, detected for the first time that the Virgo Nebula (N. G. C. 4,594) had a radial velocity of 1,000 kilometers a second, and a rotation of about the same, and now C. O. Lampland, of the same institution, has discovered the proper motion of the same nebula, that is, its motion in relation to the other heavenly bodies, this being the first determined proper motion among the nebulae. The nebula observed is the one that looks like the planet Saturn, with a black lane through it.

Paris Academy Continues its Meetings.—The French Academy of Sciences is still continuing its meetings, so that we will be able to keep up our news from this body At the last meeting M. Francotte, professor at Brussels University, telegraphed his thanks for the sympathy which the Academy expressed to that nation at a previous meeting. A paper was presented about the last eclipse of the sun by Messrs. Baillaud and Bigourdan, of the Observatory. M. Laveran communicated a note from M. Danitz on treatment of sleeping sickness by arsenical compounds.

A Spanish Institute of Oceanography has recently been established by royal decree, under the direction of Prof. Odón de Buen, for the purpose of carrying on investigations in the waters adjacent to Spain, including practical studies relating to fisheries. The institute, which has its headquarters at Madrid, has absorbed the laboratory of marine biology in the Balearic Islands and the stations of marine biology at Santander and Malaga. Additional stations are to be established at Vigo and in the Canaries. An oceanographic museum and an aquarium will form parts of the establishment at Madrid. The institute undertook a cruise in the Mediterranean this season.

Agricultural Co-operation in the Philippines.—There are nearly a million small farmers in the Philippines, and as yet little has been done toward organizing any kind of co-operation among them. The need for such co-operation is now to be met on a comprehensive scale. According to a plan inaugurated by Vice-Governor Martin, a provincial agricultural society is to be organized in each province. Delegates from the provincial societies will meet in Manila and organize an insular agricultural society. On the other hand, each provincial society will endeavor to create a local agricultural society in each municipality of its own province. The whole system will be closely affiliated with the official Bureau of Agriculture, and the Director of Agriculture will be *ex officio* president of the insular society. Several insular councils will be established to promote individual rural industries. Thus there will be insular councils for rice, tobacco, cocoanut, abaca, live-stock, and maize.

The Meteorological Service of Formosa was organized under an ordinance of the Japanese government in 1896, and placed under the Bureau of Communications of the colony. In addition to the central observatory at Taihoku, the service has observatories at Taichu, Tainan, Koshun, Hokoto (Pescadores Islands), Taito, and Sharyoto (at the mouth of Keelung harbor). Observations are also taken at 10 lighthouses, and there are 100 rainfall stations scattered over the island. Weather telegrams are regularly received at Taihoku from all the observatories of the service, as well as from numerous stations in Japan and on the China coast, and from Manila. Weather maps are compiled, and weather forecasts and storm warnings covering the whole island are issued daily. All observatories in the island are provided with Gray-Milne and Omori seismographs. The service has just issued a comprehensive work on the climate, typhoons, and earthquakes of Formosa. A novel fact brought out by this work is that the station of Kashoryo, near Keelung, has the remarkable annual rainfall of 288.9 inches, and is probably the wettest place in the Far East

The End of a North Polar Expedition.—A press dispatch, dated September 1st, reported the arrival at Archangel of the surviving members of the expedition which left Russia in the autumn of 1912, under Capt Sedov, in the hope of reaching the North Pole by way of Franz Josef Land. The survivors report the death of their leader from illness, while attempting to sledge north from Franz Josef Land. This expedition was financed chiefly by the well-known St. Petersburg newspaper, the *Novoya Vremja*, and was generally believed to be badly equipped when it started north. The undertaking was not favored by the Russian government Sedov's previous Arctic experience had included an expedition to the mouth of the Kolyma in 1909, and one to Nova Zembla in 1910, but the impression prevailed when he left Russia on his final journey that neither he nor his men had sufficient skill, training or equipment to give hope of valuable results from their expedition. The winter of 1912-13 was spent at the Pankratiev Islands, off the northwest coast of Nova Zembla. The following summer, eight of the twenty-two members of the expedition were obliged to return to Russia on account of illness. The others were supposed to have sailed for Franz Josef Land, but as no further tidings were received of them the Russian authorities recently sent an expedition in search of them on the steamer "Hertha."

Aeronautics

Another Stabilizer.—In a patent, No. 1,106,808, Baldwin J. Hamilton, of London, England, presents an aeroplane the two sides of whose plane are so constructed and connected that an excess of air pressure on one side will produce automatically a stabilizing action on the other side.

Another Protecting Garment for Aviators.—Richard Kockrow, of Nieder, Lausitz, Germany, has secured a patent, No. 1,104,808, for an aviator's protecting garment formed of layers of felt and aluminium, spring spaced apart to protect the wearer from the shock in case of a fall.

Pneumatic Suit for Aviators.—Nazaire Lacrotte, Paris, France, has patented, No. 1,105,569, a pneumatic suit for aviators, motorists and the like, having helmet, dress-plate, thigh protector and shin guards of special construction, and suitably connected so they will be maintained in proper position upon the wearer

Aids in Directing an Aeroplane.—In a patent, No. 1,104,542, James Robertson Porter, of Holborn, London, England, presents an aeronautical machine in which air is drawn in from the upper end by a fan and expelled downwardly and which has a conical deflector and flaps controlling the discharge of the air according to the direction of travel desired.

Providing Stability Planes in Series.—Walter L. Marr, of Flint, Mich., in patent, No. 1,104,056, provides stability planes at intervals along the under surface of the upper main plane with their centers of resistance above the center of gravity of the machine and operating to aid in arresting or preventing a lateral movement of the machine if the main planes up-tilt laterally.

A Zahm Flying Machine Improvement.—Alfred Francis Zahm, of Washington, D. C., has secured a patent, No. 1,107,231, for a flying machine in which a plurality of lateral ailerons are moved to different angles relatively to each other by means which permit the ailerons automatically so to adjust themselves under the varying impact of the air as to receive equal pressure.

Another Flying Machine Improvement.—Patent, No. 1,106,061, to Josef Schroeder, Tegel, Germany, assignor to General Electric Company, is for improvements in flying machines which supply wings pivoted or hinged at their front ends and elastically supported at some point in rear with the especial object of maintaining the lower or supporting stand wires under constant tension.

An Improved Flying Machine.—A patent, No. 1,105,941, for flying machine, has issued for the invention of John Francis Tiner, of Uvalde, Tex., in which the inventor seeks to provide for the more efficient utilization of artificially produced air currents than in the apparatus commonly employed, by means of axially elongated propellers for moving the air current with greater force

Aeroplane Balancing Devices.—Patent, No. 1,106,099, to Frank T. Jones, of Baltimore, Md., seeks to secure the automatic balancing of an aeroplane by combining with a plurality of independently pivoted balancing planes at desired locations on the machine a universally movable pendent member connected with such planes to automatically move them, some in one and others in another direction.

A Wireless Telegraph Installation for Aeroplanes.—L. Rouzet, of Paris, has patented, No. 1,106,729, a wireless telegraph installation for aeroplanes especially designed with a view to protecting the aviator against fatal or other electrical shocks because of such installation. In fitting up the aeroplane with a floating antenna, provision is made for insulating all the fixed parts of the installation.

Aiding Equilibrium by Adjusting Propeller Blades.—In a patent, No. 1,104,039, for a flying machine, the invention of Carl Dienstbach, of New York city, the inventor utilizes, in connection with an aeroplane, a propeller with pivoted blades whose angle of inclination can be changed at will by the aviator to give a positive or negative lift to the part where the propeller is located, for controlling the equilibrium

A New Glenn Curtiss Flying Machine.—Glenn H. Curtiss, in patent, No. 1,104,036, provides various details of construction applicable to both aeroplanes and hydro-aeroplanes including a frame adapted to be moved by the swinging of the aviator's body for operating equilibrium restoring devices, and a second laterally movable frame for another operator, which second frame may be placed in or out of operative relation to the equilibrium restoring devices.

Aeroplanes in the Arctic.—The two expeditions sent north this summer by the Russian authorities to seek missing Russian exploring expeditions—viz., the "Hertha," which is looking for the Sedov expedition, and the "Eclipse," which is seeking the Brussilov and Russanov expeditions—are equipped with aeroplanes, the use of which, in connection with polar expeditions, has been much talked of during the past two years, but has not yet been actually attempted As previously reported in these columns, aeroplanes are also expected to figure in the expeditions of Payer (1914) and Amundsen (1915),



The massive steel falsework for the 180 foot arches was built in sections in the shops, shipped to the site, and erected by means of a double cableway.

Tunkhannock Creek Viaduct.

The Tunkhannock Railway Viaduct

Construction of the Largest Concrete Arch Bridge in the World

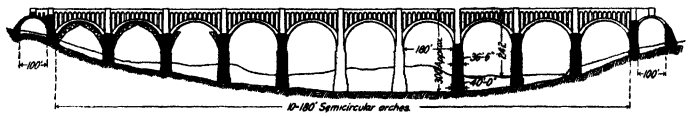
THE Delaware, Lackawanna & Western Railroad is engaged in reconstructing forty miles of its system between Clark's Summit, Pennsylvania, and Hallstead. The significance of the work lies in the fact that the company, in eliminating curvature and reducing grades on this section, is willing to expend $12,000,000, having estimated that the reduction in the cost of operation of the new as compared with the old line will render this great expenditure a profitable investment.

The work is of a heavy character throughout; but the two most notable and picturesque structures are the concrete viaducts, one over Tunkhannock Creek and the other over Martin's Creek, the former calling for 157,000 cubic yards of concrete and the other for 78,000 cubic yards. The improvement includes among other things the elimination of twenty-two grade crossings, in which all the structures carrying the roadbed will be of concrete wherever there is sufficient clearance to permit of its use. Altogether, if we include the material in these minor structures, of which there are eighty, the railroad company is using in this stretch of forty miles a total of 400,000 yards of concrete.

The Tunkhannock bridge has an extreme length over the masonry of 2,375 feet, and its height from the bed of the stream to the top of the coping is 242 feet, and from rock foundation 300 feet. The bridge consists of ten semi-circular arched spans, each 180 feet in the clear between piers, and of two 100-foot semi-circular abutment spans, which are of sufficient width to carry two railroad tracks. As will be seen from our illustration, the main arches and the piers are of massive construction. The superstructure of the arches to the coping, consists, for each span, of ten vertical members rounded off into as many small semi-circular arches which carry the roadway. In addition to the 167,000 cubic yards of concrete, there were used in this bridge, 2,275,000 pounds of reinforcing steel and 43,500 cubic yards of material had to be taken out for the foundation. All of the piers, which measure 36 feet 6 inches by 43 feet 6 inches, are built solid below the springing line. And all piers are carried down to rock, which was reached at a depth of from 10 to 95 feet below ground level. Hence the extreme height of the highest pier from bedrock to coping was 300 feet.

As will be seen from our illustration the falsework for carrying the arches during erection was of very high character, consisting of four spans of arched trusses, which were built in sections at the shop, transported to the site, and erected by means of a double aerial cableway, as shown in one of our illustrations.

The design is of very simple and appropriate outline, and the bridge as completed will form one of the most monumental engineering works in existence.



Elevation of Nicholson Viaduct, showing progress to November 1st.

Marine Oil Spreader

THE value of oil for calming rough seas has long been recognized. The reason it is not more extensively used is probably because few vessels are provided with special apparatus for distributing the oil properly. When in time of extreme distress a vessel finds it necessary to use some method of quieting the waves, the only means of distributing the oil is to pour it down the scuppers, or as is sometimes done to fill a canvas bag with oil, perforating the bag so that the oil can escape, and hang the bag over the side of the ship. Sometimes a hose is used to distribute the oil. The difficulty with these methods is that the oil is discharged in the wake of the drifting ship, and as the oil spreads comparatively slowly, the ship is constantly moving out of the quieted area. Recently H. W. Stocking of San Francisco has devised an oil distributing apparatus which permits of distributing the oil where needed, and far enough from the vessel to quiet the sea measurably before it reaches the vessel. Furthermore, the amount of oil discharged may be controlled accurately from the vessel. The apparatus consists merely of a sea or drag anchor which may be let out from the ship to the required position, and which also carries a flexible pipe line terminating in a nozzle. The oil is delivered through this pipe line to the nozzle, where it is discharged. The distribution of oil may be controlled by throttling the pipe line. The sea anchor, which may be of the usual conical form, preferably with an opening in the small end of the cone to prevent the anchor from swaying, serves to retard the drift of the vessel enough to keep it within the area affected by the oil. As the oil is distributed to windward at a considerable distance from the vessel, this distance being directly under the control of the ship, it may be discharged at the proper point to quiet the waves before they reach the vessel.

Improved Castor

THE principal objection to the ordinary castor is the fact that a hole must be bored in the furniture leg to receive the shank of the castor or the socket if the castor is of the socket type, and when the shank or the socket is hammered into place as is necessary to prevent it from dropping out, there is danger of splitting the wood. To avoid this S. Rummel of this city has invented a new castor consisting of two parts, one of which is secured to the furniture by means of an ordinary screw. This part has a dome-shaped face, and it may be used as a so-called "dome of silence." However, the periphery of this member is threaded to receive the socket of the castor proper. Owing to this threaded connection, there is no danger of the castor's falling out when the furniture is lifted. When desired the castors may be unscrewed and furniture moved by sliding it on the dome-shaped members.



Photograph by courtesy of *Flight*.

A general view of the hangars at Upavon, on Salisbury Plain, England.

THE Central Flying School at Upavon, on Salisbury Plain, is a very important part of the organization for military aviation in that it is intended as a center of instruction for both the naval and military services. That it was in the nature of an experiment goes without saying, but its success has justified its inception, thanks to the personality of the officers who were placed in charge of it from the first. The situation is open and notoriously windy, a circumstance which, in contradistinction to many otherwise preferable, and from the point of view of learners, more attractive, flying grounds on the continent of Europe and elsewhere, affords a more suitable area for training men who will be expected to go out in practically all weathers, according to the exigencies of the service.

The buildings devoted to aeronautics number about sixteen sheds of different capacities, offices, lecture rooms, repair shops, and a department of meteorology, but the government has also already commenced the erection of permanent buildings, including quarters for the permanent staff officers, of whom there are thirteen, with four assistant instructors, two from the Navy and two from the Army, with a large permanent staff of mechanics. The school is organized for instruction in four flights, in each of which the machines are of one type at present, but pupils are shifted and changed about from one flight to another in accordance with their proficiency, in order that they may acquire a knowledge of all the types used in the air services. Flying begins with the dawn, say at 3:30 A. M. or 4 A. M., and goes on till about 8 A. M. After that work is performed in the workshops and sheds until noon, followed by a lecture before the midday meal. Two hours rest is allowed in the afternoon in view of the necessity for exceptionally early rising, and from 5 P. M. to dusk, flying goes on once more. Physically and mentally it is distinctly a strenuous life, but healthy.

During the month of June there was a special concentration camp for airmen at Netheravon, which was attended by five squadrons of military aeroplanes coming from all parts of the country, besides the Kite Section, the Aircraft Park, and the various headquarters aeroplanes. Altogether seventy machines were available.

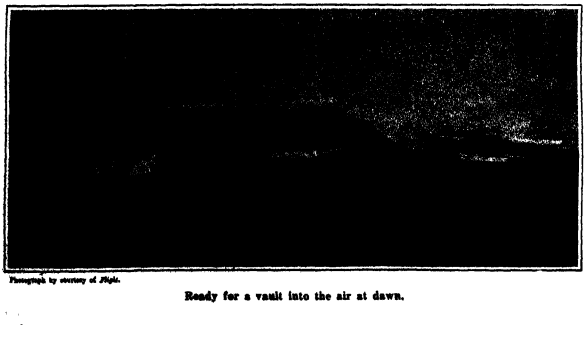
The move of the squadron stationed at Montrose was



Photograph by courtesy of *Flight*.

A group of pupils with their instructors.

made the occasion of a test march across country under active service conditions, keeping in touch with the transport—a very different matter to the mere concentration of aeroplanes from various stations by way of the air alone, without the hampering condition of having to be met by their transport at the end of each day's journey, like the movement which was so brilliantly carried out not long ago by the German air service. The scheme of the Montrose squadron involved daily flights on the part of the machines of only 80 to 100 miles, but the whole of their motor transport had to meet them in camp at the end of each day, carrying everything that would be required for upkeep and repairs. The transport train included no less than twenty-three motor vehicles of all sorts, and traveling at intervals of 200 yards, they covered about two and one half miles of road while in progress, and had to move a distance of 600 miles between Montrose and Netheravon, and as their freight included spare parts for every one of the twelve aeroplanes of the squadron and four spare engines, it may be realized that it was not light. Although there was a regrettable and fatal disaster, through fog, at Northallerton, when two officers unfortunately lost their lives on duty, the journey, as a whole, was successful and instructive. Normally each squadron of military aeroplanes has a strength of 19 officers, 2 warrant officers, 21 sergeants, and 115 rank and file, and requires a transport train of 38 vehicles, and the transport for such an assemblage of aircraft which encamped at Netheravon this year would include 42 light motor vehicles, 36 heavy tenders, 36 motorcycles, 36 trailers, 12 supply lorries, 24 repair lorries, 18 shed lorries, 24 reserve equipment lorries, altogether a total of 228 vehicles, which if spaced at 200 yards while on the march, would cover 26 miles of roadway.



Photograph by courtesy of *Flight*.

Ready for a vault into the air at dawn.

The work of the Concentration Camp opened on June 2nd with a conference of all officers, at which the commanding officer explained briefly the objects of the camp, viz: to test in various ways the degree of training of the "personnel" both on the ground and in the air, the work and handling of aircraft and transports and experiments of numerous sorts, also the study and co-ordination by means of lectures, discussions, conferences, and specially de-

tailed committees, of the innumerable problems, such as mobilization, technical and military training, observation, including observation of artillery fire, workshops, stores, meteorology, wireless telegraphy, photography, bomb-dropping, and organization of all kinds, which are essential to the building up of an air service for military purposes on a firm and efficient basis.

Although seventy machines were available, it was obvious that flying and the carrying out of tests with aircraft was only one phase of the instruction carried out, as will be seen from the brief notes of the work accomplished, and it will be readily understood that the results of tests could not in many cases be made public, for reasons of military expediency.

During the first week the weather was anything but favorable and very disappointing, considering the time of year. Heavy rain and hail swept over the Wiltshire Downs, followed by slight frost, and a bitter northeast wind of 30 miles an hour, and gusty at that. A scheme of maneuvers was set by the Camp Commandant for the first day, which was primarily intended to test the value of reconnaissance from aircraft of troops stationary on the battlefield. The hostile troops were represented by the individual transport motorcyclists and men of the Royal Flying Corps, who were dispatched early in the morning with confidential instructions to take up positions and remain stationary, principally at cross-roads, within the area covered by the operations, and keep time till 1 P. M.; these positions were, of course, kept secret from the reconnoitering officers who were sent off later in the day and allowed one and one half hours in which to observe and make notes, on the understanding that they were to keep their machines at an altitude of not less than 2,500 feet. Each aeroplane carried a pilot and observer, and the latter was provided with a map of the theater of operations, and had to make his notes in the air and hand in his report immediately on return to camp. The results were not published, but are understood to have been satisfactory, and the pilots managed their machines exceptionally well in face of the very gusty wind. During this week the demonstrations of rigging and tuning up of aeroplanes which took place from time to time, for the special benefit of the rank and file of the Royal Flying Corps, were found to be very instructive from a practical point of view.

Observation of artillery practice was carried on during the second week, together with other work of an experimental nature, of which the results were not made public; speed tests, climbing and landing tests were carried out, the latter including flying by night and landing by the light of special flares.

It is recognized that since a military aviator may frequently have to land in an unknown part of a foreign country and get away again, and even during maneuvers in his own country can never be certain where he may have to come down, the power of landing with safety is one of the most important parts of his training, and is studied accordingly, both as regards choosing at a rapid glance around the best available landing place, and making the best landing practicable under unfavorable circumstances.

On June 30th the aircraft exercises consisted of aeroplanes searching for a disabled aircraft, represented by a balloon, which ascended from a point unknown to the searchers, some thirty miles from the Concentration Camp. The altitude of the balloon varied from 2,000 to 5,000 feet, and as the day was hazy, it could only be seen from a distance of eight miles at the farthest; nevertheless it was found by 50 per cent of the aerial scouts who were sent up in the aeroplanes to look for it.

Throughout the whole period of the month in camp the reconnaissance tests and practice were continuous and progressive, as was only natural, seeing that observation of the enemy's movements and dispositions is the end and aim to which all else connected with military aviation is subsidiary, and there can be no doubt that the combined training of all ranks and the opportunities for conference, exchange of ideas and mutual instruction, in addition to listening to lectures and discussions on various topics, were of the utmost advantage to all who took part in this first Concentration Camp for Aircraft in Great Britain.

The Canadian Arctic Expedition

ACCORDING to information received in Toronto September 1st, Stefánsson, the leader of the Canadian Arctic Expedition, set out from Martin Point, northern Alaska, on March 22nd, last for a sledge journey northward over the sea ice. After sending back a supporting party at the edge of the continental shelf, in latitude 70 degrees 20 minutes, longitude 140 degrees 30 minutes west, the leader proceeded with two men, one sled, six dogs, two rifles, and plenty of ammunition. He expected to turn back at the end of fifteen days, but thought he might be driven by winds and currents to Banks Land. Nothing, however, has since been heard of him, though two vessels have cruised along the coast of Banks Land in search of him. The southern section of the expedition, under Dr. Anderson, left Herschel Island about August 17th for Coronation Gulf, where explorations will be carried on in accordance with the original programme. A dispatch from Nome, dated September 1st, announced that the revenue cutter "Bear" had failed in its attempt to reach Wrangel Island, where Stefánsson's northern party took refuge last season after the loss of the "Karluk." The "Bear" was within 20 miles of the island on August 21st, but after fighting ice and storms for six days was forced to return to Nome for coal and provisions. She is now engaged in another attempt. The former revenue cutter "Corwin" has been fitted out by miners at Nome and has sailed on a similar errand of relief. Meanwhile the hope is still cherished that the Russian ice-breakers "Taimyr" and "Vaigatch," which are making their third annual cruise in the Arctic, may succeed in bringing off the marooned explorers.

German Men of Science and the British Association

AMONG the party which proceeded to Australia to attend the meeting of the British Association were a number of distinguished German men of science, who, in most cases were accompanied by their wives, daughters, or sons. Germany's war with Great Britain has necessarily placed these scientists in a position of difficulty, since they are subject to the orders of the Commonwealth military authorities, as regards departure from Australia, and even in that event, their destination must be a matter for official cognizance and settlement. Perhaps the most popularly known men are Dr. A. Penck, professor of geography in the University of Berlin; Dr. F. von Luschan, professor of anthropology in the same university; and Dr. J. Walther, professor of geology and paleontology in the University of Halle. Included also among the visitors were a number of American, Russian, and Danish scientists.

It is possible that the temporary hospitality of America, a non-belligerent power, may prove a way out of the grave situation that has arisen, one unique in the annals of science, and of unforgettable character.

For the information of our readers we append a list of American scientists who accepted the invitation of the British Association to its Australian meeting:

Mr. C. G. Abbot, director Smithsonian Astrophysics Observatory, Washington.

Mr. Z. Baker, professor of geography and geology, University of Chicago.

Mr. F. Baker, Scripps Institution for Biological Research, San Diego, Cal.

Dr. Lyman J. Briggs, Department of Agriculture, Washington.

Dr. R. T. Chamberlin, Geological Department, University of Chicago.

Dr. E. G. Conklin, professor of zoology, University of Princeton.

Dr. C. B. Davenport, director Department of Experimental Evolution, Cold Spring Harbor, Long Island.

Prof. W. M. Davis, Harvard University.

Dr. G. A. Dorsey, curator of anthropology, Field Museum of Natural History, Chicago.

Mr. C. F McClure, Department of Comparative Anatomy, Princeton University.

Mr. E. S. Moore, professor of geology and mineralogy, School of Mines, Pennsylvania State College.

Prof. Ira Remsen, Johns Hopkins University, Baltimore.

Dr. H. C. White, professor of chemistry, University of Georgia.

Dr. W. M. Wheeler, professor of economic entomology, Harvard University.

War Issue Number 2 of the Scientific American

THE September 5th issue of the SCIENTIFIC AMERICAN —our War Number—has met with the success that we anticipated. Carefully prepared with the assistance of military men, each an expert in his special field, it met a popular demand for accurate information on the technical aspects of modern warfare, which seems to be insatiable. Large as the number was and packed with articles and pictures of the most timely character, it could not possibly exhaust the subject. Accordingly, it has been decided to make the next monthly magazine number of the SCIENTIFIC AMERICAN—that which will bear the date October 3rd—another war issue, in which subjects will be discussed fully as important as those which were taken up in the September number, but which the limitations of space prevented our considering at all.

We have heard very much, for example, of the turret fort, which was used with such brilliant success at Liege, but which finally succumbed to the enormous siege artillery which the Germans eventually brought to bear. Here we have at once two subjects on which practically nothing has appeared: The modern fixed fortification of steel and concrete, and the means for reducing it. The October 3rd issue of the SCIENTIFIC AMERICAN will, therefore, contain an elaborate drawing and description of the famous Liege forts, with photographs showing exactly what was the effect of the German siege artillery upon it; and also an article on those marvelous 16-inch siege guns which, by high angle fire, dropped hundreds of pounds of high explosive upon hapless defenders crouching behind their protection and manfully serving their guns to the last.

We have heard much, too, of the floating mines with which the Germans have sown the North Sea, and which have proved such a menace to neutral shipping. How are these mines constructed? What is their effect? How does a battleship guard itself against them? These questions will all be taken up in an authoritative way.

The submarine boat, too, will command its share of attention. Sectional views of boats will be published and the interior mechanism of a submarine revealed just as if it were a watch that has been picked apart.

Of fortifications in the field much also may be learned from the October 3rd issue of the SCIENTIFIC AMERICAN. It is known in a general way to the public that obstacles of every kind are thrown in the way of attacking infantry—barbed wire, felled trees with all their branches and similar barricades. Such obstacles and defenses are thrown up very systematically. The character of the obstacles and the methods of placing them in position will be described and illustrated.

John Barrett, director of the Pan-American Union, was the first to draw the attention of American manufacturers to the trade opportunity which confronts them as a result of the war. The SCIENTIFIC AMERICAN has asked him to prepare an article in which the prospects that now tempt the American business man are carefully considered. Letters from prominent financiers, merchants, and manufacturers on the subject will also appear.

A Street Traffic Signal

TO ease the work of the traffic policeman and afford a far greater measure of protection to the traveling public, Mr. H. D. Heuer of St. Louis, Mo., has invented a device by means of which the guardians of the traffic will not only be protected from the weather, but will be relieved of the strain of extending their arms and removed from the direct center of traffic. Mr. Heuer offers to give his invention to the public. The device is exceedingly simple in construction, and by no means expensive. It consists of an overhead signal or semaphore, operated by a traffic officer who is removed from the direct path of traffic and stationed in or under a shelter house, which is slightly elevated, on the street corner, where he can observe and direct the movements of traffic by operating the signal device and signal bells. He is consequently out of the danger zone himself, and can devote all his thought and energy to minimizing the risk of others. The signal will be suspended from a cable attached to poles located on diagonal corners, and in plain view of pedestrians and vehicle drivers for a long distance.

The signal consists of four semaphore blades, each about 36 inches long, constructed similarly to an electric ceiling fan, two of the blades being colored red, signifying "danger" or "stop," while the other two will be colored white, and will signify "clear" or "go ahead." To render the signals effective by night, electric lamps will be provided for the semaphores, the colors being in accord with the colors of the semaphore blades. The signal is moved 90 degrees in both directions, the attention of the public being called to the change by an electric bell, which is situated on the pole where the traffic guardian is standing.

When the signal is not in use as a guide to traffic, the semaphores may be placed diagonally, which would be an indication that the traffic guardian is absent and traffic could proceed under its own control.

The Current Supplement

IN the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2020, of September 19th, will be found a splendidly illustrated article on the Canadian Alps, which introduces a new American playground and scientific storehouse that will be appreciated by all lovers of natural scenery. There is a second installment of Prof. Bateson's remarkable address on Heredity, which is being published in full, and every line of which will be read with interest by laymen as well as scientists. A New Application of Roentgen Rays tells about an infallible method of establishing the authenticity of oil paintings, and the detection of forgeries in art. America's Opportunity by a World Catastrophe is an interesting resume of history, and discusses a matter that is engaging the attention of the whole country. The Industries of Liege tells of its great manufactories and many timely facts about the modern artillery produced there and in other European countries. The conditions governing the coming contest for tractor biplanes at San Diego, by the U. S. Army officials, contains matter of value to all connected with the building of aeroplanes. There is also much other valuable matter.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Force It Takes to Stop a Motor Car

To the Editor of the SCIENTIFIC AMERICAN:

In the issue of July 4th this year there was an inquiry with reference to the force required to stop a motor car, and you announced that you would be glad to hear from your readers on the problem. I have seen no response in the later issues and would submit the following as an approximate solution of the problem.

The specific inquiry was—what will it take in weight or power to stop an automobile weighing 3,500 pounds, traveling 20 miles an hour, within 30 feet.

One and one half times the number of miles an hour is a very close approximation to the number of feet per second, and we may, therefore, take the velocity of the car as 30 feet per second.

The energy of the assumed car in foot-pounds is, therefore, approximately $3{,}500 \times 30 \times 30 \div 64.4$

$$E = \frac{W v^2}{2g}$$

or 48,913 foot-pounds.

As the car is to be stopped in 30 feet, the force in pounds required to be exerted throughout the stop is $48{,}913 \div 30 = 1{,}630$, which is nearly one half of the weight of the car.

From the equation $h = \frac{v^2}{2g}$ for a falling body, we should also find that the height through which the car would fall in acquiring the velocity of 30 feet per second, is about 14 feet, and as this is a little less than one half the distance in which the car is assumed to be stopped, it will require a force of a little less than one half of the weight of the car $\left(\frac{14}{30}\right)$ acting through the space of 30 feet to absorb the energy of the car and bring it to rest. $\left(\frac{14}{30}\right) \times 3{,}500 = 1{,}633$, which confirms the previous computation.

The time required to bring the car to rest is equal to the distance, divided by one half of the velocity at the moment when the stopping force begins to act, in this case $30 \div \frac{1}{2} \times 30 = 2$.

The work, 48,913 foot-pounds, is, therefore, performed in two seconds, or at the rate of 24,456 foot-pounds per second, and as a horse-power performs 550 foot-pounds of work per second there would be an exertion $24{,}456 \div 550 = 44\frac{1}{2}$ horse-power in bringing the car to rest.

Conversely 44½ horse-power would generate a velocity of 20 miles per hour in a space of 30 feet, if nothing but the inertia of the car were taken into account.

As a practical matter there would also be the road friction, running gear friction, air resistance and the like to be overcome, so that much more than 45 horse-power would be required to accelerate the car to that speed within that distance, if it were possible to be done.

For a like reason somewhat less than the force or power computed as above would be required as a braking force to stop the car, for the road friction and air resistance would assist, and the running gear friction acts in effect as a brake, in so far as it opposes the free rotation of the wheels.

It is much more important to know the minimum distance in which a car can be brought to a stop from a given speed, than to know the force required or power consumed. There is no difficulty in making brakes to give the maximum retardation attainable by braking action.

The limit to the retarding effect, and to the reduction of distance within which the stop can be made, depends upon the frictional or tractional hold of the wheels on the road surface, and this varies greatly with the condition of the road, being very small on a wet and muddy or "greasy" surface.

Without having any definite information, I judge that the coefficient of friction between a good gravel or macadam road and the usual pneumatic tire without chains is about 0.4, and that it is rarely more, and frequently much less than that in ordinary driving conditions.

If we take the coefficient of friction of tire on road as 0.4 we have only four tenths of *one* half of the weight of the car as the maximum retarding resistance derivable from the brakes, when, as is usually the case, the brakes are on the driving pair of wheels only, and the weight of the car is about equally divided between the front and rear wheels.

We have computed that it takes a force of about one half the weight of the car to stop the car within 30 feet, from a speed of 20 miles per hour. We have, however, less than a quarter of the weight of the car available as a retarding force, and consequently from 60 to 65 feet is the shortest distance in which a car can be stopped from that speed by the brakes on a level road with an excellently holding road surface.

The distance, it will be seen, does not depend upon the weight of the car, except for wind and road friction resistances and the like, which are not very large factors in coming down from 20 miles per hour. A three-ton car can be stopped by its brakes in about as short a distance as a motor cycle, although it would take a much larger number of telegraph poles to bring the car up short than it would to stop the motor cycle.

Drivers should also remember that the distance in which a car can be stopped by the brakes increases as the square of the speed. It is four times as great from a speed of 40 miles per hour as from 20 miles per hour, and 9 times as great from a speed of 60 miles per hour. About 250 feet is the least distance in which a car can be stopped from 40 miles per hour, and over 500 feet from 60 miles per hour. The wind resistance gives quite an appreciable aid, however, at the higher speeds.

In stopping from 20 miles per hour the car will travel 45 feet before its speed is reduced to 10 miles per hour, and 15 feet further in coming to a full stop from the 10-mile speed.

Except with an excellent road surface the distances will be much greater, and possibly by the use of chains they might be reduced a little, but if a driver is willing to subject his car and tires to the strain I think he will find by actual test that the distances above given are the best he can make.

Of course if all four wheels were equipped with brakes the distances would be about one half of those above indicated.

There are various other factors that might be discussed if space were available.

A general formula for the least distance in which a car can be stopped by its brakes (on rear wheels only) is:

$$D = \frac{v^2}{gf}$$

where

D is the distance in feet.
v is the velocity in feet per second.
g is the acceleration of gravity in feet per second
f is the coefficient of friction of tire on road

It will afford a reasonably safe margin to take f as 0.3 (30 per cent), and a good working approximation is afforded by dividing the square of the velocity by 10 to give the distance in which the car can be stopped on a good road surface in good condition, i. e.,

$$D = 1/10\ v^2;$$

or, divide the square of the speed in miles per hour by 4.4, or say by 5, to give an easily computed result with a reasonable margin of safety. This would give 80 feet as the distance when the speed is 20 miles per hour.

Boston, Mass. JOSEPH P. LIVERMORE.

The War of the Nations

To the Editor of the SCIENTIFIC AMERICAN.

Without entering into the partisanships or race animosities of Europe, without taking sides in what is their affair, and not ours, on a basis of our natural sympathies, does it not still behoove us to consider what effect the result of this great conflict may have on our own interests and destinies as a nation? For that such an effect it will have is undeniable

Should the allies win, the *status quo ante bellum* will be largely resumed so far as the world outside of Europe is concerned except for the annihilation of German commerce. It is true England will no longer be menaced by Germany, therefore will be more strongly confirmed in her naval superiority; but, on the other hand, England will still have enough to take care of with the other nations without resuming her quondam position of bully against this nation.

Should, on the other hand, the allies be defeated, Germany would become supreme on the seas and assume the Napoleonic rôle of France a century ago. Assuming this position can be maintained, the German navy and mercantile marine would dominate the world. Which, then, is most to our interest as a nation?

The prime, if not only, fact to remember in deciding this question is that whereas England has always supported our Monroe Doctrine, Germany has always been hostile to it; in fact, we may say that but for England we never could have supported it until now Germany is, among the nations, a "bounder" or "climber," as the English aptly term one who eagerly elbows his way to the front without regard to the rights or interests of others. With her rapidly growing power she has asserted her voice more and more loudly in "Weltpolitik," and without considering her eager competition in the South American trade as being other than an amicable one, we cannot properly neglect to note her assertiveness in matters closely touching our own sphere of interest, notably in the Mexican and San Domingan muddles. It is well understood that Germany covets naval stations or other territorial outposts in the West Indies, and it cannot be a bad guess that she would follow the same tactics to get them as she did, for example, in the case of Kiao Chao, or Austria in the case of Bosnia, or both of them in the present war. The Teutonic policy of territorial forward movement has always been one of sudden seizures, taking would-be opponents by surprise and then pleading *fait accompli*

With Germany in the ascendant, it goes without saying that we should have to greatly strengthen our naval power and to maintain the utmost vigilance to prevent some such surprise against us somewhere in the new world, with the almost certainty of becoming ultimately embroiled ourselves in a war with Germany that would reduce us, as it previously reduced the other nations, to a secondary place

To these considerations is to be added that of similarity of national ideal as between Germany and the allies. Germany puts forward as her great slogan the repression of the slavic "barbarians", but the facts of history are not to be forgotten Without even mentioning the century-long friendliness of Russia for the United States, unbroken by any unfriendly act, let us go back again to the sequel of the Napoleonic wars when the so-called Holy Alliance was formed by Russia, Prussia and Austria with the object of upholding absolutism in general and preventing the revolt of the Spanish colonies in America in particular It was this very Holy Alliance, led by the three European autocrats, but opposed, be it remembered, both by Great Britain and France, that led to the establishment of our historic Monroe Doctrine. Names and circumstances have changed, but national character has not Western Europe and the United States still remain the free countries of the world, and eastern Europe holds the absolutist countries; the dividing line between them is clear, and so is the interest of the United States.

The effort of one country or one race to dominate all the others must ultimately come to naught, such has ever been the history of the world, and all such empires but one have been of brief duration, the single exception being due to the enormous concentration of civilization at a single point. Ultimately such an empire as that of Napoleon expands until it falls to pieces of its own weight, but in the meantime such a military predominance as that threatened by the Teutonic civilization at this time, even for a few years, would work serious and possibly irreparable injury to our interests.

Milwaukee, Wis. GEORGE W. COLLES.

An Opinion of Our War Number

To the Editor of the SCIENTIFIC AMERICAN:

I wrote you on yesterday that the SCIENTIFIC AMERICAN for September 5th had not been received. I beg to inform you that it came this morning I am sorry to have troubled you, and trust this will reach you before you have sent us another copy

Permit me to say this paper contains far the most complete and comprehensive information in regard to the war that I have seen anywhere.

I am buying an extra copy for my personal pleasure

My husband, the late William Ogilvie, ex-Governor of the Yukon Territory, was for many years a constant reader of the SCIENTIFIC AMERICAN, and one of your very strong friends. I feel you may be pleased to know this. (MRS.) O. P. R. OGILVIE,

Ottawa, Canada. Librarian, Mines Branch.

For Passing Through Mine Fields

To the Editor of the SCIENTIFIC AMERICAN:

In these days of loose floating mines would not a rope net device projected off both sides of the bow of a slow-moving ship (after the manner of the familiar cow-catcher on a locomotive) tend to lessen the danger of destruction by such mines? It seems to me the slow speed of vessel (which is presumed under such conditions) would deflect a mine in many cases and at least prevent a percentage, even though small, of losses at the present time

I have been told by friends that this is an impractical suggestion and altogether not feasible Will you kindly give me your opinion on the subject?

New York. CHARLES P. FAY.

[The idea is not altogether impracticable. If the net were of wire and capable of being lowered on booms from the bows, it would form an effective mine-exploder, when a ship was passing, at slow speed through a mine field.—ED.]

Artificial Rubber from Coke Oven Gases

AT a recent meeting of the Iron and Steel Institute in London, its president made this significant statement: "It is being sought to obtain from coke oven gases those hydrocarbons the derivatives of which are found in rubber Experiments that have been made permit the foreshadowing of the manufacture of artificial rubber from this source"

An Automobile Radio-Telegraph Station for War Use

Wireless Car for the French Army Equipped with Powerful Field Apparatus

By Jacques Boyer

THE new automobile wireless station of the Compagnie Générale Radiotelegraphique is the most powerful field station of this sort that has yet been constructed. The vehicle, which carries its own crew and supplies, can travel 250 miles without reprovisioning, and can then send wireless messages continuously for five hours. The first communications, made for the purpose of adjusting the instruments, were recently exchanged between Chateauroux and Paris, a distance of 186 miles, with complete success. The constructors of the portable station hope soon to increase this range by making some changes in detail, but the results already obtained are sufficiently remarkable to invite attention.

The chassis of the car, made of hammered steel plates and solidly braced, is of the 16 horse-power commercial Renault type, approved by the Minister of War. It can carry a load of 5,500 pounds. The hooded four-cylinder motor corresponds to the following specifications: interior diameter of cylinders, 3.5 inches; stroke, 5.5 inches; valves controlled by a single arbor with cams; ignition by high voltage magneto, automatic carbureter with braked air valve, capable of using gasoline, benzol, or carbureted alcohol.

The speed changer, which gives four speeds forward and one backward, carries a pinion and gearing for driving the alternator in the interior of the car. The pinion is engaged and disengaged by moving a hand lever. The control of the speed changer is also effected by means of a hand lever, without lateral displacement, and the motion is transmitted to the wheels by a shaft provided with a universal joint.

There are two systems of brakes. One brake, operated by a pedal, is applied to the transmission shaft, immediately behind the speed changer. Another pair of brakes, controlled by a hand lever, is applied to the rear wheels.

The irreversible steering gear, comprising an endless screw and a helicoidal sector, controls the levers of the fusees by the intermediation of a damping tube. The wheels, made of wood, with hubs of the artillery type, have solid rubber tires, single for the front and double for the rear wheels. The chassis measures 18.6 feet in length and 6 feet in width.

The body of the car is designed to afford the maximum of comfort to the thirteen operators that can be carried with their equipment. In order to prevent the sound of the wireless apparatus from escaping and betraying the presence of a wireless station, the cabin is inclosed in double walls with an interlining of felt. The alternator is placed in a closed, but demountable, compartment in front, beside the driver's seat, behind which are the wireless telegraph instruments, a table and several upholstered benches, sufficiently long and wide to be used as couches.

The mast is made in interchangeable segments, which are carried on the roof of the car. It is erected in the field by three men, in the following manner: The segments are assembled on the ground, like those of a fishing rod, and the mast is then raised by means of a pole and a tackle. In this operation the mast turns on a broad plate which serves as its base.

The antenna is composed of six cables of hard bronze wire, which are attached to the insulator at the mast-head and are stretched laterally by cords attached to pegs driven in the ground. Insulators of reinforced ebonite are interposed between the cables and the cords. The mast-head is connected with the car by a stranded wire. The earth connection is made by six strips of wire netting, about fifty feet long and twenty inches wide, which are laid radially on the ground around the station.

The current required for the operation of the wireless apparatus is furnished by a self-exciting monophase alternator of very light construction. The alternator is driven by the motor of the car, with which it can be connected by moving a lever attachment to the speed changer.

The rheostat of the exciter is mounted on an insulated base within easy reach of the operator.

A static transformer of the commercial type, immersed in oil, raises the voltage from 250 to 4,000. The transformer is carefully insulated and is protected from return currents of high frequency by two choking coils, without iron cores.

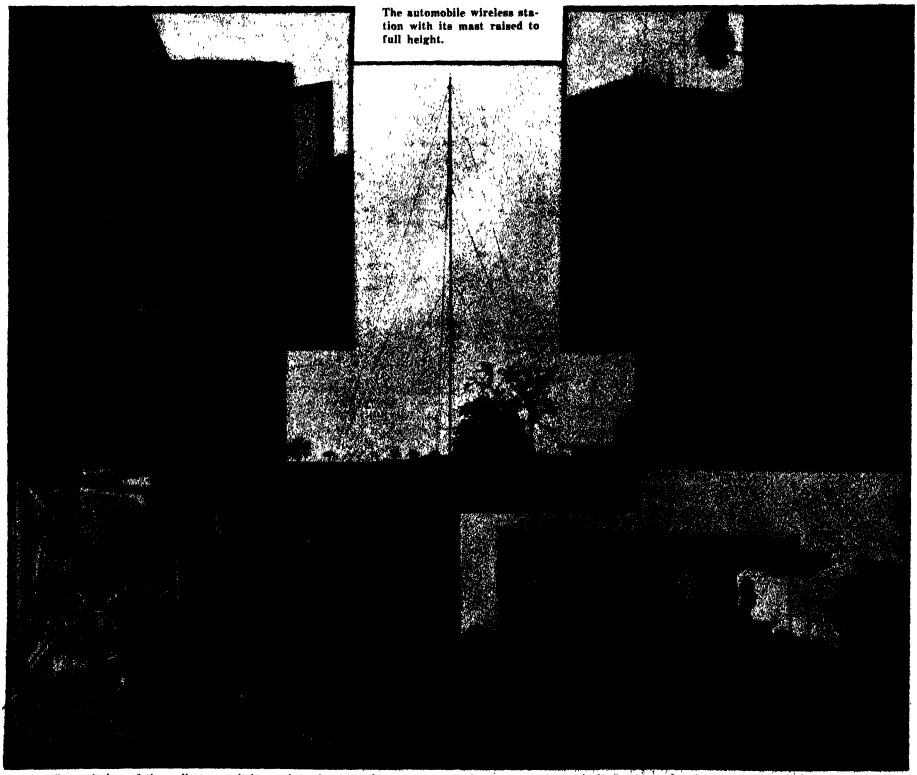
The apparatus also includes a thermic voltmeter, with its commutator, a thermic amperemeter, a quick-acting

(Concluded on page 238.)

The operator at work in the portable station.

The automobile wireless station with its mast raised to full height.

The alternator beside the driver's seat.



General view of the radio transmitting and receiving station.

The automobile partly broken away, to show the radio-telegraph apparatus.



Left—The third baseman has missed a wild throw from the field, and although the ball has passed him ten feet, he has not yet [illegible]. This illustrates the speed of a thrown ball. Right—Catching a runner napping at first. The slide by the runner gained the time required by the fielder to stoop and touch him. Center—Two out and three on bases, and what he did. The ball is half way to the base, but the catcher's hands are not yet down.

Time as a Factor in Baseball

What Must be Done in a Fraction of a Second

By C. H. Claudy

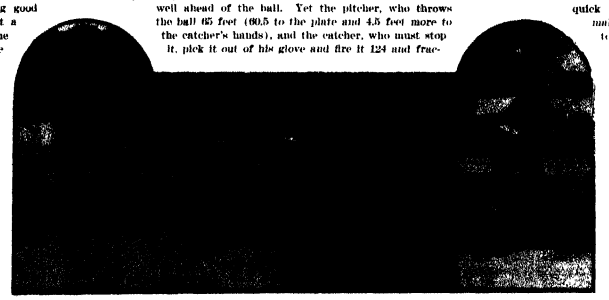
THE fathers of baseball builded better than they knew when they laid out the first diamond and decided upon the weight and size of balls and bats. The popularity of the game as a spectacle depends largely upon its uncertainty, and its uncertainty depends entirely upon the relation between the distances between bags and the plate, the distance a ball can be batted and thrown, and the time required to make the ball travel, whether propelled by arm or bat.

As every "fan" knows, the bases are 90 feet apart. The fastest time ever made about the bases from home to home was 13⅘ seconds, and this not during a game. Fifteen seconds about the bases is fast time, or 3⅘ seconds between bases with a running start for all except first base. First base has been made from the plate on a bunt and run in 3½ seconds, but the time is very unusual, 4 seconds flat being good time. Ask a "fan" how fast a ball batted so it strikes the ground in the infield before it is fielded goes on the average. He will guess anywhere from 30 to 300 miles an hour! But hold a stop-watch on all batted balls during a game and count only those which are infield grounders, and you will find that they average about the speed of a fast express train—say 66 miles an hour, or 88 feet per second.

The shortstop will play from 110 to 135 feet from the plate. Suppose he gets an infield grounder 125 feet from the plate. At 88 feet a second, it has taken 1.4 seconds to reach him. Allowing 1.7 seconds for the throw to first base, he has 0.9 of a second only in which to make the catch, draw his arm back, and make his throw. Yet more men are thrown out at first base on ground balls fielded by the shortstop than ever beat the throw to the first station! The play is almost always close—so close that one of the differences between a good and a poor first baseman is that the good one will reach far forward to get a ball, knowing that the time it takes the ball to travel the 6 feet he can reach may make the difference between "safe" and "out!"

It is because of this delicate balance between time of batted ball and throw, and the ability of a man to run 90 feet, that the baseball authorities are so rigid in their requirements of the structure, size and weight of a baseball, and why major league players can play with none but major league balls made by one of two great firms. They know, these baseball Solons, that a fraction of an ounce difference in weight, a fraction of an inch difference in size, may weigh down the balance in favor either of the fielder or the batter—and the balance (and so the uncertainty) must be kept as perfect as possible.

When a man gets on first base, his next thought is of second—the station only 90 feet away, which looks so near and is so far. A good base runner *may* be able to take a "lead" of 10 feet—though he must needs be very good indeed to do so with a clever pitcher. He may thus reduce the distance between bases to 80 feet. With a standing start, any good base runner should make this distance in 3 seconds. Starting as the pitcher begins to deliver the ball, it would seem easy enough to slide into that bag in 3 seconds time, well ahead of the ball. Yet the pitcher, who throws the ball 65 feet (60.5 to the plate and 4.5 feet more to the catcher's hands), and the catcher, who must stop it, pick it out of his glove and fire it 124 and fractions feet to second base, unmake between them to handle the ball so quickly that in the majority of cases the ball is waiting for the runner when he arrives, giving the shortstop or second baseman who caught it plenty of time to reach forward and down and touch the runner with the hand which holds the ball. If a total of 3 seconds be allowed for the two throws, and 0.3 of a second be allowed the catcher to catch, set himself and throw, then the ball travels 184.5 feet in 2.7 seconds, or at the rate of 69 feet a second. This rate must be again divided, since the pitcher's pitch is much more rapid than the catcher's throw. From 100 to 120 feet per second is average speed for a fast ball such as is thrown by Walter Johnson or Joe Wood. The catcher can get no such speed on his throw, since he must throw along a curved trajectory, which at its greatest height is 8 or 9 feet in the air. Part of his throwing force is put into making the ball climb. Fans who do not know the game sometimes speak of a catcher as throwing "weak" because his throw fades down to the ground at second base. As a matter of fact, the good catcher expects to have his ball reach second base a trifle to his right of the bag and low down. He hopes for this because the minute fraction of time between the fielder's catch at the ball and his dropping his hands to "get" the runner may make the difference between "safe" and "out." For the same reason the base runner slides. He doesn't make quite as fast time sliding as he would running. But he is under the necessity of stopping quickly and "on the bag," and of keeping his anatomy as far away from the fielder as he can. Sliding makes him certain of a quick and sudden stop, and also makes it necessary for the fielder to drop his hands (which takes time) to touch him. Hence the catcher saves this extra fraction of time with a low throw.



Blocked off at second base.

Fungo batting.

Ask the bleacherite which can be hit the farther, a fast pitch or a slow one, and he will correctly tell you the former. But he won't know why. Were a baseball pitched infinitely powerful and were he to throw a hundred balls, each time a little faster than the previous time, there would come an instant when the force of the ball forward would be equal to that inherent in the shoulders and but of the batter—the bat would break, and the ball fall "dead."

But the modern pitcher, powerful though he is, is far from that point. The force he puts in his pitch must, physically speaking, be added to the force in the batter's swing. The resultant of the two is the force in the batted ball. If the pitcher pitched with all his force at a stone wall, the ball would rebound. The harder he pitched, the greater the rebound. It is because the rebound is greater from the bat when the stick meets a fast pitch than when it meets a slow one, that the longest hits are made from fast pitching. Of course, fast pitching is hard to hit because that element of "time" enters again—the batter, expecting one sort of pitched ball, has too small a fraction of a second after recognizing the pitched ball as a "fast one" to change his mind or "unset" his muscles. Hence

(Concluded on page 448.)

The Micro-structure of Steel

By J. F. Springer

THAT somehow carbon enters into the composition of steel is no new fact. The method of manufacture and chemical analysis each testifies to this. But neither gives any adequate information as to just how the carbon is distributed. Thus chemistry may tell us that a certain sample of steel contains 0.80 per cent carbon. Does this mean that every piece of the steel however small will contain carbon in the same percentage? This is a question which the chemist seems unable to answer. But the microscope furnishes the required information, and gives a negative answer.

Consider what this means. It means, first of all, that steel is *not* a chemical compound. Water is such a compound, and wherever you have a quantity of pure water, be it large or be it minute—there you have hydrogen and oxygen in the ratio of 1:8. In the second place, it *may* mean that some portions of the steel may not contain carbon at all. And, in fact, steel is not only not a chemical compound, but it does consist of particles some of which contain carbon and some of which do not.

Apparently wherever the carbon occurs, it is in chemical combination. That is to say, steel does not contain particles of carbon. It contains molecules of carbon in combination with molecules of iron, the two forming iron carbide, Fe_3C. Indeed, some think there may be more than one carbide. But the great fact is to be emphasized—carbon does not occur as free carbon.

On the other hand, the iron does occur by itself as well as in chemical combination with the carbon. A special name has been given to the pure iron. Metallurgists speak of it as *ferrite*. The iron carbide (Fe_3C) has also received a special name, *cementite*.

Now there is another important fact, which is true of steel as of other metals. When steel solidifies it crystallizes. If it be permitted to cool without undue haste or unsuitable manipulation, the crystals will be found to be quite large—so large indeed that when the lowest powers of the microscope are used, it is scarcely possible to get an entire grain within the field. Upon examination of such a grain or part of a grain, it will be found, if the surface has been properly prepared, that long stripes appear which may be more or less curved but which are incredibly thin, so thin, in fact, that upward of 25,000 would be required to cover an inch. Now each of these stripes is known to consist of two layers—one of ferrite, and one of cementite. The structure or complex thus formed, consisting of these two substances intermingled in the way described, or sometimes as granules of cementite in a matrix of ferrite, is called *pearlite*. This name has been given to it because of the iridescence of the lamellar variety reminding the observer of mother-of-pearl.

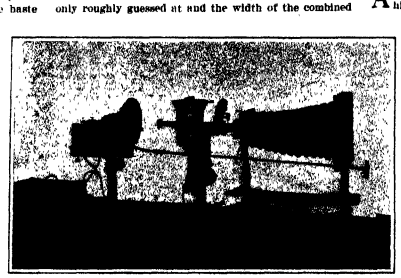
Sometimes the steel will consist entirely of pearlite. This is, according to some, when the carbon content is just about 0.90 per cent, and when it has not been suddenly cooled from a high temperature, as by plunging into cold water. However, if a less amount of carbon or a greater amount be present, there will be an excess in the one case of ferrite and in the other of cementite. With a certain percentage of carbon, the ferrite and the cementite will be so balanced as to produce just pearlite. But if the carbon falls below this percentage, there will be too much ferrite. The excess will be found in "veins" or envelopes around and between the grains of pearlite. If on the other hand there is too much carbon, an excess of cementite will be formed which will occur in veins around and between the grains of pearlite. If we examine two photographs, the one showing an excess of ferrite and the other an excess of cementite, they may appear very similar.

It will interest some to know that experiments have been made to determine the hardness of ferrite, cementite and pearlite. The ferrite has been found to be comparatively soft. If we take it as a basis of comparison, it has been ascertained from averaging a large number of tests that pearlite is about 4 times as hard. Cementite has been determined to be about 272 times as hard as ferrite. It might, at first sight, seem incredible that with one of its constituents so excessively hard, pearlite should be as soft as it is. But this result is due, no doubt, to the fact that in pearlite the hard cementite is interstratified with the soft ferrite.

There are other constituents of steel—of the hardened varieties—but none is so hard as cementite, according to the elaborate tests which have been made by H. C. Boynton. Mild steels contain, then, as hard a constituent as any steel. They are soft because the cementite does not occur in large amount and because of the manner in which it is intermingled with the ferrite.

It is a simple matter to determine the amount of cementite in a sample of carbon steel whose chemical composition is known. For *all* the carbon is taken up in this form (as scientific knowledge stands to-day). Taking account of its formula—Fe_3C—and remembering that the atomic weights of iron and carbon are, respectively, 56 and 12, we calculate at once that the carbon is combined with 14 times $(56 \times 3 + 12)$ its weight of iron. So that, whatever the carbon percentage may be, 15 times that percentage represents the cementite percentage $(14 + 1 = 15)$. Thus, if the steel has a carbon content of 0.40 per cent, the cementite will constitute but 6 per cent of the whole, by weight. Of course, it may occupy more than 6 per cent of the volume.

Suppose now that the steel has a carbon content of just 0.90 per cent. It will then, as has already been observed, consist of pearlite alone. If we calculate the cementite present by multiplying the carbon percentage by 15, we shall get 13.5. This means that pearlite consists of 13.5 per cent cementite and 86.5 per cent ferrite. As before, these percentages refer to weight and not to volume. Probably the cementite has a lower specific gravity. But, even so, the presence of nearly 6½ times the weight of soft ferrite would seem to go far toward explaining the softness of pearlite. Now the thickness of a strip of cementite plus the thickness of a strip of ferrite in lamellar pearlite may be taken as about 1/25,000 inch. Assuming that the specific gravity of cementite is ⅞ that of the ferrite, we conclude that it occupies 4/3 of the space, weight for weight. Instead then of the volumetric ratio being 1:6.4 (13.5 per cent : 86.5 per cent), it will be 1.3:6.4. That is, the cementite occupies roughly 1/5 the space taken up by the ferrite—or, what is the same thing, 1/6 of the volume of the pearlite. The little strip of cementite, then, which occurs in lamellar pearlite may be estimated as having the incredibly small thickness of 1/6 of 1/25,000. This gives 0.0000067 of an inch. It must be remembered that this result cannot be regarded as anything more than an estimate, since the relative specific gravities are only roughly guessed at and the width of the combined stripe is hardly known with exactness. Now the instrumental means by which the constitution of unhardened steel may be microscopically observed and a record made is an interesting piece of apparatus. Accompanying this article is shown a photograph of an instrument of this character made by E. Leitz and in use at Columbia University.



Microscope and camera for use in making metallographic observations.

It will be noticed that there is a long bed frame from which four standards rise. The one on the left carries the means of illumination, together with a disk pierced at the center. The carbons of the arc light are in plain view, although the focus of the arc is hidden within the hood. It is possible to manage and adjust these carbons so as to maintain the arc itself at a definite point. Further, the arc may be brought up close to the disk or withdrawn from it. The two standards on the right carry the camera and are so mounted that the positions of the sensitive plate and of the outer end of the bellows may be adjusted independently. The remaining standard seen at the center of the view carries two distinct parts of the apparatus. One of these is the stand upon which the specimen to be examined is placed. This part may be moved vertically independently of the other part, consisting of a system of tubes. One of these tubes, projecting horizontally toward the left, is provided with a condensing lens by means of which the stream of light coming from the arc light through an iris-diaphragm arranged on the disk may be collected and condensed upon a prism. This prism is arranged within the box-like compartment vertically beneath the specimen seen on the stand. Just above this prism is a microscope. When the light from the arc reaches the prism, it is deflected upward through the microscope and onto the under surface of the specimen, which it thus illuminates, the stand being perforated for this purpose. The light is then reflected back through the microscope. As it leaves the microscope it falls upon a second prism somewhat to the right of the former one. By means of it the stream of light is brought again to the horizontal and now traverses the horizontal tube seen to the right and into the camera. However, by means of a third prism carried by the same projecting obliquely off from the right-hand horizontal piece, the stream of light may be intercepted and passed through a suitable ocular arranged on the outer end of the tube. This detail of the apparatus is controlled by a thumb-screw. The observer is thus furnished with a means of viewing the image that is to be formed on the sensitive plate. Indeed, it enables the operator to use the apparatus without reference to photography. It will be remembered that the stand is vertically adjustable independently of the tube *system*. The object of this is to enable the metallographer to vary the distance between the surface of the specimen and the object glass of the microscope. In the present instrument this variation of distance is admirably secured without disturbance of the course of the illuminating stream of light. In other words, the proper adjustments necessary to conduct the light properly from the generating arc to the sensitive plate may all be made without taking into account the power of magnification to be used. The wheel seen back of the central standard operates a rack and pinion for large movements of the stand. The finer ones are made by either one of two heads. One of these is in view and may be controlled by the flexible rod extending within reach of the operator when at the camera. The other rod, whose control is also within his reach, enables him to manage the arc.

It is by means of such apparatus as this that the new and vigorous science of metallography is making such notable contributions to our knowledge of the constitution of steel and other alloys.

The Dewey Decimal System for Filing Pamphlets, Clippings and Books

ABOUT thirty years ago, Mr. Melvil Dewey devised his well known system of decimal classification, now extensively used in American libraries, both public and private. The system has the immense advantage of being infinitely extensible, so that it is easily adapted to the needs of a growing library or collection of books. All knowledge is classified into ten main divisions; each division is subdivided again into ten parts; and each of these parts is likewise capable of subdivision into parts. Subdivision can be carried further to any desired degree. Whatever the merits of the Dewey system may be, its author was not sufficiently acquainted with science and engineering to prepare a satisfactory classification for them. In the earlier editions "Electrical Engineering" is made a subdivision of "Mechanical Engineering." In the latest edition there is no recognition of "Genetics," and "Eugenics" is classed under "Evolution" instead of "Biology." As a result of these defects, librarians of scientific and engineering societies have made special extensions of the Dewey system to suit their own purposes. Thus the Engineering Experiment Station of the University of Illinois has published an admirable extension which covers the entire field of mechanical and electrical engineering, an extension which has been partially incorporated by Mr. Dewey himself in the latest edition of his classification. The Iowa University School of Mines has made a very elaborate extension to cover mining engineering and geology. Among private libraries, that of the General Electric Company has published a very minute and useful subdivision of the Dewey system, which covers the entire field of electrical engineering. Unfortunately these and similar independent efforts to adapt the Dewey system to the requirements of specialists, do not agree with one another. There is no need for this disagreement. It should be simple enough for librarians of special collections to agree upon a classification which will be accepted by all those who realize the immense advantages of the Dewey decimal system. Eventually there will be one system of decimal classification, and the longer we wait to establish it, the more difficult it will be to conform to it when it becomes imperative.

An Antidote for Wasp Stings.—At this season of the year it not infrequently happens that persons biting ungiardedly into fruit in which a wasp is concealed receive stings in the mouth or throat. Such stings may be exceedingly dangerous and even fatal, since the affected tissues swell rapidly and this is liable to cause difficulty in swallowing and breathing. An effective antidote is employed in Switzerland, according to *l'Illustration*. "The sting is rubbed vigorously with garlic, or, if it is too deep in the throat for this treatment, a few drops of the juice from bruised garlic are swallowed. If garlic is not to be obtained onion may take its place, but is a less active agent." The efficacy of this simple remedy was verified by a Swiss specialist, who found it important enough to be presented at a session of the Vaudois Society of Medicine.

The Smallest Public Service Plant in the Country

By George Frederic Stratton

THE smallest hydro-electric station in public service is in the gulch of a torrent which races down through the Little Cottonwood Canyon in the Wasatch Range in Utah. But its diminutive size is by no means its chief distinction. It is a municipal power-plant, built and operated by a city of 4,000 inhabitants, and as an illustration of what clean, municipal enterprise and management can do, it is claimed to be without a parallel.

Placed in operation but a few weeks ago, it has excited very great interest and very close scrutiny from small towns all over the West where water powers are obtainable for development, and from many other towns where steam power would have to be used.

For several years this little city of Murray had been served with electric lights and power by a large producing company, but there was water under tremendous headway coming through that canyon and running over the bench lands for irrigation. Very evidently great economy was the spur, and the city raised $80,000 and built this plant.

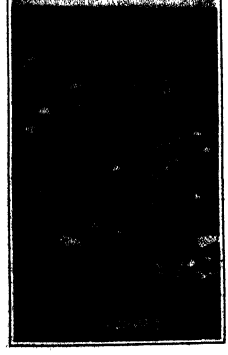
Arrangements were easily made with the irrigation water owners to use the power running to waste, and the house was built in the foothills two miles from the canyon mouth. The intake and dam are a half mile up the canyon, and the fall from the dam to the turbines is over five hundred feet.

From the intake to the house the water is conducted through a 30-inch wood stave pipe. There are two turbines and generators, each of 600 horse-power, and which can be operated as separate units or together. The current is generated at 2,300 volts; stepped up to 6,600 volts for transmission over the six miles of wires into the city, and there it is reduced again to the proper voltage for either power or light.

When that little city was buying its current for street-lighting and water-pumping the cost was close to $300 per month. Now that cost is entirely cut off. Not one dollar per month needs to be charged up to that public service, and although the income from the citizens for house lighting and power pays all operating expense, the rates to them have been astoundingly reduced. The lighting rate has been cut from 10 cents per kilowatt hour to 7½ cents; the rate for cooking and heating from 5 cents to 2 cents per kilowatt hour, and the rate for power is now 2 cents, against a former rate of 14 cents. On large, steady quantities of power, on day-load only, contracts are offered at less than 1 cent per kilowatt hour. In fact, 100 horse-power can be secured at a flat rate of $150 per month. As far as is known, no current is offered so cheaply by any plant, even in the great region of the innumerable water-powers of the intermountain country.

And, after passing through the turbines, the water runs into the irrigation canals. Not one pint of it is lost or wasted.

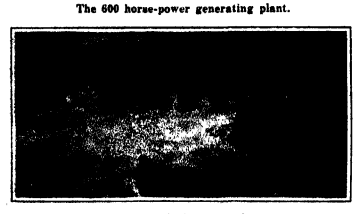
The operating force consists of a manager, whose office is in the City Hall, and who looks after the sales and distribution; two attendants at the power-house—one on day duty, the other on night; and an occasional intermittent inspector of the pipe-line and dam. There is no reservoir; a small covered settling basin serving every purpose, for those canyon streams, fed all through summer by melting snows on the high peaks and deep ravines miles back and up in the mountain range, never fail.



The 30-inch wood stave pipe.



The 600 horse-power generating plant.



The dam in Little Cottonwood Canyon.

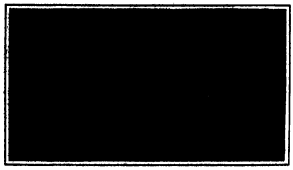
Electric Speed Indicator for Locomotives

A NEW speed indicator for locomotives employs an electric system consisting of a small alternating current dynamo run from the axle, whose speed is proportional to the axle speed. The alternator sends current into an electromagnetic apparatus containing a set of small metal tongues or reeds placed opposite a magnet, the reeds being tuned so that only one of them enters into vibration, according to the rate of pulsation of the electric current. Alongside the set of reeds is a scale with figures, so that when any particular reed is seen to vibrate, the figure is read off, and this gives the rate of the current vibration, or in other terms, the number of revolutions of the locomotive wheel or the speed of the locomotive on the track. A suitable chart allows of direct reading the speed in miles an hour.

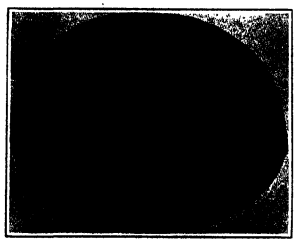
Rubber Foam

By Paul James

WHILE all the other parts of automobiles have been brought so nearly to a state of perfection that it is possible to travel thousands of miles without



Small cylinders and sphere of unvulcanized rubber transformed into large cylinders and sphere of rubber foam.



Rubber foam as it appears in the microscope.

making repairs, the rupture and bursting of the pneumatic tires still constitute sources of delay and accident. None of the many spring devices proposed as substitutes for pneumatic tires has given good results in practice. A good pneumatic tire should be both flexible and elastic. India rubber is flexible enough, but it is not sufficiently elastic.

The solution of the problem appears to be furnished by a new material of remarkable properties, which is produced by an ingenious process in Paris. This product consists essentially of India rubber containing multitudinous minute bubbles of gas, distributed throughout its mass. The material resembles a rubber sponge in which the cavities are separate and do not communicate with each other. Hence it has received the name "*caoutchouc mousse*," or rubber foam.

The process of manufacture is based on the increase of solubility of gases with increase of pressure. Rubber in the pasty stage of vulcanization is inclosed in a steel tube with nitrogen at a pressure of 3,000 to 4,000 atmospheres. The compressed gas dissolves in the semi-liquid rubber, which, when the tube is opened, expands to four or five times its former volume and solidifies, imprisoning in its mass myriads of little gas bubles, so that it resembles, in structure and properties, an assemblage of tiny rubber balloons.

The material, in fact, combines the properties of its two ingredients. It is as flexible as rubber and as compressible as a gas, so that it may be employed, in the form of a solid ring, in the place of the air tube of an automobile or bicycle tire. A tire so constructed is non-collapsible, for a puncture affects only a few of the innumerable gas bubbles.

Another valuable property of rubber foam is its lightness. Its density varies from 0.4 to 0.17, according to the quantity of gas forced into it. Hence, it is an excellent material for life-preservers and small folding life-rafts. It is also a very suitable filling for cushions and chair seats, and especially for horse collars, as it is light, impenetrable, and does not scratch or gall the skin if the cover is broken. It is also used in shoe soles, tennis balls, etc.

Rubber foam possesses still another valuable property. It is the best heat insulator known, and about twice as efficient as its nearest competitor. It has already proved its excellence as a lining for ice-boxes and refrigerating apparatus. Ordinary glass bottles, covered with a layer of rubber foam, keep liquids hot or cold.

Three-letter Linotype Matrix

A RECENT invention offers a new linotype matrix and attachment for the vise making the matrices three-letter instead of two, thereby saving the printer money in matrix fonts, and also in the time now used in changing magazines to obtain additional type faces. Three different faces of type, of any size up to and including 12-point, may be cast from one magazine without lessening the operator's speed in the least. Faces Nos. 1 and 2 are obtained in the ordinary way through the assembler, while a touch on the button on the vise gives the third face. Double-deck machines, having now four type faces, with this invention may carry six, three-deckers nine, and multiple-magazine machines twelve different type faces. Many job plants have only a dozen different faces in common use. The device permits the use of two type faces, besides the body type of any publication, from a single magazine. All that is necessary to make the change on the ordinary linotype of any model is a slight change in the attachment on the vise and on the mold. Any machinist can do the work in a very short time. No change whatever is made in the assembler, the lines being assembled exactly as with the two-letter matrix. Another advantage is found when it becomes necessary to recast lines. Now, on work where black and light faces are needed, lines must be reset or reassembled. With the three-letter matrix the lines may be recast without resetting. Many double-deckers in newspaper offices are used at a disadvantage because of the lack of a third face. The inventor is Mr. J. A. Quinn, of New York city.

A New Use for Concrete

IN building a ferry landing stage at Sydney, Australia, a big pontoon made of reinforced concrete was adopted. It was 100 feet long, 48 feet wide at one end and 43 at the other, and 7 feet 9 inches deep, giving it a freeboard of 32 inches. The bottom was flat, and the sides and ends were given an inclination of 70 degrees. The pontoon was divided into 48 water-tight compartments, and was carefully reinforced and strengthened to withstand the pressure of vessels lying alongside. A live load of 150 tons is provided for, and the structure weighs 650 tons. It is expected that this concrete structure will require little attention in the way of repairs, will be permanently water-tight and will overcome many other troubles that the ordinary wooden or steel pontoons are subject to.

Compound Railroad Tie.—A railroad tie in which a metallic jacket is shrunk upon a wooden core is shown in patent, No. 1,102,693, to Charles L. Sevier, of Academy, W. Va.

Motorcycle Machine Gun

THE designer of the new fighting machine shown in the accompanying photograph is Quartermaster-Sergeant H. R. Northover of the Ninetieth Regiment of Canadian Militia. The motorcycle with Maxim gun mounted on a sidecar chassis has a greatly increased radius of effective action as compared with other artillery. It can travel four miles per hour (the pace of infantry march) or be hurried to a distant point at a rate faster than forty miles per hour

In the maneuvers at the barracks, when word was received that the Ninetieth Regiment probably would be in the first division from Canada to be sent to Europe, the motorcycle artillery was driven for two and one half hours through lines of people extending from the sidewalk to the middle of the road; it traveled through water and plowed fields; it went everywhere with the rest of the artillery The chief advantage, however, of the motorcycle Maxim gun is its superior speed, compared with other artillery, and the rapidity with which it can be mobilized where needed for effective action.



A motorcycle machine gun.

Reconstruction of the Kiel Canal

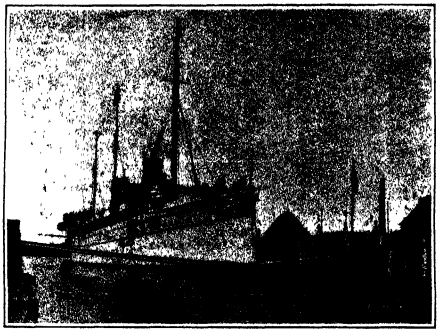
IN 1895, after eight years of hard work, the great canal running from the mouth of the Elbe, in the North Sea, to the Fjord of Kiel, in the Baltic, a distance of about sixty miles, was thrown open to commerce. It had a normal width of 72 feet at the bottom and 220 at the water level, with a depth of 29½ feet. Although a sea-level canal, twin locks were built at each end, those at the western entrance to take care of the large tide variations, and those at the eastern end to take care of variations of water level, in the practically tideless Baltic, due to gales. The locks were 492 feet long, 82 feet wide, and 32 feet deep The locks at Kiel remained open most of the time, while those at the mouth of the Elbe did not need to be used at certain tides.

The canal proved wonderfully valuable to commerce, because it saved the long, hazardous trip around the stormy coasts of Denmark But its strategic value to the German navy was of even greater importance, as has been demonstrated in the present war.

Although the locks, when built, were large enough to take almost all vessels, they were outgrown in time, even by warships, and finally it was decided to reconstruct the canal, making it broader and providing locks that could take the largest vessel afloat, with plenty of room to spare. This work was completed in time to be of incalculable value to Germany in the present war.

The normal width of the canal is now 335 feet at the surface and 144 at the bottom, with a depth of 36 feet. New twin locks have been built alongside the old ones at each end. They have an available length of 1,082.6 feet and width of 147.6 feet Intermediate gates may be used to cut off a chamber 328 feet long. The locks at Panama, it will be recalled, are only 1,000 feet long by 110 feet wide

The work of reconstructing the canal cost $55,000,000. The new locks were formally opened by the Kaiser, recently, in the manner shown in the accompanying illustration The royal yacht "Hohenzollern" may be seen breaking a ribbon of black, white, and red stretched across one of the new locks



The "Hohenzollern" breaking a ribbon of black, white and red, at the opening of the new Kiel Canal locks.

Draft Dogs in War

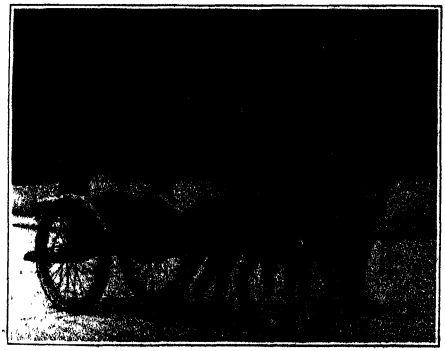
DOGS have long been used in the European armies for carrying messages from an advanced post or patrol to headquarters, for watching supplies and the like, for assisting sentinels on the advance lines, and for similar purposes Shortly before the beginning of the present European conflict, dogs were introduced in the Belgian army as draft animals American tourists who are at all familiar with Belgium will no doubt recall that dogs are used by the peasantry for the hauling of light loads. It is perfectly natural, then that the Belgian military authorities should use dogs for the transportation of light machine guns. An interesting article on this subject appears by Capt Oefele in a late number of *Umschau*. "In all armies but the Belgian," says Capt. Oefele, "machine guns and their ammunition are transported either upon ordinary vehicles drawn by horses or upon the backs of mules and horses. Belgium, which introduced the machine gun only this year, has built specially light vehicles for the transportation of the weapons and their ammunition. The first experiments were made with a single company. They were so successful that it was decided to adopt dogs for the transportation of machine guns throughout the army. Each of these machine gun companies consists of three officers, sixty-eight men, six transporting carriages drawn by dogs, and twelve ammunition carts, also drawn by dogs. It was intended eventually to supply each company with forty dogs, which were to be bred and trained at the main dog station at Beverloo. Hence, each company has four dogs in reserve, when its eighteen small carts are harnessed." This idea of transporting machine guns by means of draft dogs was an idea of the Belgian lieutenant van de Putte. A machine gun must be able to follow the infantry, no matter what may be the character of the ground, and must be as invisible as possible on the march as well as in action. Furthermore, a machine gun must be transported as noiselessly as possible and must be set up ready for action as quickly as possible. All these conditions seem to be admirably fulfilled by the system devised by Lieut. van de Putte.

"The gun carriages," continues Capt. Oefele, "are very light, and the harness is so designed that the movements of the animals are hardly impeded. The carts are provided with good springs; their axles run in ball bearings; the wheels are rubber tired; and the carts are so nicely balanced that the dogs need not be harnessed between poles, but simply hitched directly on traces. Each machine gun is drawn by two dogs. The load which can be thus transported is about 420 pounds.

The dogs must not be too heavy. They must be strong and possess considerable endurance. Dark colored dogs are preferred, because they are less conspicuous than light dogs. Still it has been found in practice that even yellow dogs may be used, if they are not too brightly colored. It is very essential, indeed, that the dogs should be anything but combative, and that they must not be given to barking. Hence, they must be trained, from puppyhood up, to silence.

In Holland experiments have also been made for the transportation of machine guns by draft dogs, in accordance with the Belgian system A march of 129 kilometers (77.4 miles) was made in five days, the men, of course, traveling on foot. At night the dogs were fed and slept in stables on straw. They did not suffer at all. After this performance came the regimental exercises. Every day, from seven in the morning until four in the afternoon, the men were put through the usual drill. The dogs showed not the slightest sign of fatigue. They hauled the guns over very difficult ground and were always in position when wanted While the guns were being fired, they lay quietly on the ground, and were ready on the first signal to haul the guns away to new positions.

During the autumn maneuvers of the Dutch troops the animals aroused general admiration. Their endurance and their obedience were remarkable. As soon as the command "Halt" was given or an equivalent signal, the dogs dropped to the ground of their own accord. They had been trained so well that they did not bark either during the maneuvers or during the night. After the maneuvers it was thought that they were probably fatigued. The inspector found them playing with one another. They were transported by railway with the machine guns in the same compartments in which the men sat; but although the railway journey lasted from 5 o'clock in the afternoon of one day until 1:30 the following morning, and the dogs were not fed in the meanwhile, they showed no signs of fatigue. They were inspected again fifteen days after the maneuvers, and were again found to be in perfect condition.



A Belgian dog-drawn machine gun.

Animals and Approaching Earthquakes

THAT animals are sensitive to the approach of earthquakes is a fact frequently observed, and the more recent seismic troubles in various countries give numerous examples of this singular faculty which many animals possess. For instance, in Japan horses set up an unusual agitation whenever a seismic shock is near at hand In Central America, dogs and cats flee from houses, and the inhabitants have become so accustomed to this that they follow the example of the animals and leave their dwellings so as to escape danger. In Italy it was observed that birds left their nests and flew up to a great height in the air, but this without noise, before the earthquake took place. However, at the time when the earthquake shocks were produced the birds uttered cries which lasted for all the duration of the earthquake. It is stated that in Sicily cocks crow and dogs howl just before an earthquake.

RECENTLY PATENTED INVENTIONS

Patents dealt with here are open to all patentees. Other sections are reserved by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

ADJUSTMENT DEVICE.—D. O'DONNELL, 620 W. 171st St., New York, N. Y. The invention relates to men's trousers, drawers and like garments, and provides a new and improved adjustment device for use on the waistband of the garment and arranged to allow convenient adjustment of the waistband to properly fit the waist of the wearer.

SKIRT MARKER.—CORA E. MCINTOSH and O. A. MCINTOSH, care former, Chenango Forks, New York. The object of the present invention is to provide a skirt marker arranged to enable a woman to quickly, accurately and conveniently mark a line around a skirt approximately at the hip, to permit of laying out the length of a skirt the desired distance from the floor.

Pertaining to Aviation.

AEROPLANE.—J. M. DAVIS, McGRAW, N. Y. This inventor provides improvements in aeroplanes whereby upsetting is prevented in high winds, sudden gusts, or on the aeroplane's passing into air pockets, the arrangement being such that the aeroplane automatically rights itself if overturned, or if it should take a header for any reason whatever.

FLYING MACHINE.—M. D. FERRIN, 363 Chicago St., Salt Lake City, Utah. The present invention relates to flying machines, and more particularly to that type of flying machine which comprises side wings movable up and down and constituting the sole means by which the machine is enabled to rise from the ground and proceed either forward or backward.

Electrical Devices.

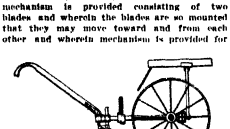
CONTACT INTERRUPTER.—A. H. MAIRE and V. H. MARTIN, 92 Rue de la Republique, Rouen, France. This device is applicable to apparatus in which a part is to be caused to vibrate by electro-magnetic action with vibrations of very small amplitude. Among these appliances electric bells with direct vibration of the bell may be cited, the bell forming an armature of an electromagnet, also appliances termed electric trumpets in which the sound vibrations are produced by a sheet metal plate subjected to the action of an electro-magnet

SYSTEM OF ELECTRICAL SELECTION.—N. L. TOLMSTAD, Groton, S. D. This system has a main circuit having between its two branches a series of cross shunt connections, each of which has in connection a current impeding means in the main circuit between each of the several cross shunt connections capable of being shunted or cut out of the main circuit in the direction of the same in which the selection of a cross shunt connection is desired, and means for cutting or shunting such current impeding means out of the circuit.

MEANS FOR PREVENTING SPARKING IN ELECTRICAL DEVICES.—L. CHUBMAN, 2309 Broadway, New York, N. Y. The principal object of this invention is to provide a new and improved core in electromagnetic devices, together with suitable means for varying the flow of the current, as to direction and amount, whereby the field may be reversed or controlled

Of Interest to Farmers.

CULTIVATOR ATTACHMENT.—W. R. STURGISS, Conway, Ark. This invention is adapted for attachment to any cultivator, either walking or riding, and wherein thinning mechanism is provided consisting of two blades and wherein the blades are so mounted that they may move toward and from each other and wherein mechanism is provided for

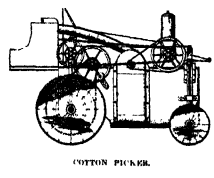


CULTIVATOR ATTACHMENT.

normally pressing the blades together to permit them to move together while thinning the row, and wherein mechanism is provided, under the control of the operator, for moving the blades apart to permit certain of the plants to remain in the row, the blades passing on opposite sides of the row when separated.

BROADCASTING MECHANISM.—J. H. PARRISH, 1106 Mutual Bldg., Richmond, Va. This invention relates more particularly to an agricultural machine by which a supply of material may be constantly broadcasted within well defined limits as to direction and extent under control of the operator, the object being to provide a machine having certain features arranged to permit of the broadcasting of liquid and powder poisons, and various forms of fertilizer, as well as seeds of various sizes and kinds.

COTTON PICKER.—M. G. CUNNINGHAM, Carrizozo, Tex. This improvement relates to a wheeled cotton picker having a power-driven suction means to pick the cotton and deliver it to a receptacle, and the invention more particularly relates to a structure in which a body of inverted U-shape directly mounts the running



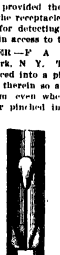
COTTON PICKER.

ding wheels, as well as a motor and the necessary driving connection to propel the vehicle and to operate suction fans arranged in connection with suction boxes on the body. These suction boxes cause the suction to be effective in a manner to act upon the cotton bolls as variously positioned on the plants of a row over which the U-shaped body is propelled

Of General Interest.

VOTIVE OFFERING STAND.—G. B. ROHNE, 34 Barclay St., New York, N. Y. This invention provides a receptacle for the money box used to receive votive moneys usually deposited in a stand specially provided therefor, and provides a cover for the receptacle and means connected therewith for detecting the removal of said cover to obtain access to the money-box.

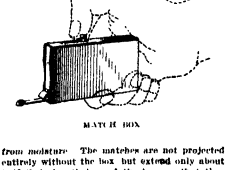
SNAKE PULLER.—F. A. THIES, 539 W. 50th St., New York, N. Y. This structure is designed to be forced into a pipe and to interlock with a snake therein so as to readily pull the same therefrom even when the snake has become "stuck" or pinched in the pipe. The



SNAKE PULLER.

snake dislodging and removing device is formed with a loosely arranged mouse structure which has co-acting therewith a knob so as to grip the snake preparatory to the removal therefrom

MATCH BOX.—S. STOLLICH and I. W. SCHREIBER, 155 Laurium, Mich. This invention relates to match boxes, and more particularly to those that are automatic in their action. One of the principal objects is to provide a box for automatically vending matches, one at a time, which will keep the matches free



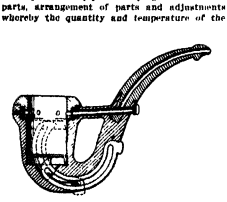
MATCH BOX.

from moisture. The matches are not projected entirely without the box but extend only about half their length beyond the box, so that they may be grasped by the operator and withdrawn. The illustration shows a perspective view of the box, showing the same in operation

DISPLAY RACK.—O. M. ARNOLD, care of Arnold, Shaff & Co., 85 Fifth Ave., New York, N. Y. This invention is for use in stores and other places, supports and displays umbrellas, canes or other articles, permits disassembling the parts into a small bundle for convenient shipping, allows the user to readily assemble the parts, supports the rack from a fixed support to facilitate the sale of the article, as the articles are singly displayed and can be readily examined as to the make and form of the handles or other characteristics of the merchandise

EXCAVATING BUCKET.—J. J. HIGGINS, Silver Creek, Pa. Address James J. Moran, Pottsville, Pa. This bucket has means for suspending the same which may be readily attached to or detached from the bucket in a minimum time. The bucket has suspending means which are less liable to be broken than the ordinary bolts.

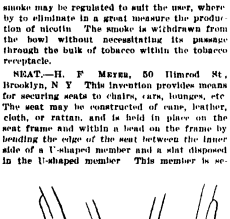
TOBACCO PIPE.—M. NEUMAN, 6314 Lowe Ave., Chicago, Ill. The purpose in this instance is to provide a pipe embodying certain novel parts, arrangement of parts and adjustments whereby the quantity and temperature of the



TOBACCO PIPE

smoke may be regulated to suit the user, whereby to eliminate in a great measure the production of nicotin. The smoke is withdrawn from the bowl without necessitating its passage through the bulk of tobacco within the tobacco receptacle.

SEAT.—H. F. MEYER, 50 Hilmrod St., Brooklyn, N. Y. This invention provides means for securing seats to chairs, cars, lounges, etc. The seat may be constructed of cane, leather, cloth, or rattan, and is held in place on the seat frame and within a bead on the frame by bending the edge of the seat between the inner side of a U-shaped member and a slat disposed in the U-shaped member. This member is se-



SEAT FOR CHAIRS, CARS, ETC.

cured to the seat frame within the bead, preferably by a strap which extends through the seat member and down at the inner side of the seat frame, the lower terminal of the strap being bent under and against the bottom of the seat frame

AUTOMATIC HAND FIREARM.—A. PYRAMO, Warner Arms Corp., 90 Chambers St., New York, N. Y. This firearm is arranged to allow of quickly and securely fastening the barrel in position on the frame and allowing the removal of the barrel, to engage the sear with the firing pin in the rear of the magazine and to control the sear from the trigger in front of the magazine, to relieve the main coil spring of the strain incident to firing, to prevent the breech lock from blowing out in case of breaking of the spring-pressed breech block guide rods, and to provide a safety device for preventing the sear from rising when the trigger is pulled, and to allow instantaneous release of the sear when desired

HORSE PROTECTOR.—B. P. WELLAND, Bricelyn, Minn. This device is especially designed to protect the feet from injury by wire either barbed or plain, wherein mechanism is provided capable of attachment to the hoof, and comprising a horseshoe of a particular construction, and protecting mechanism supported by the shoe and by the hoof the shoe being so arranged that it is not necessary to replace the same at frequent intervals, when used with young horses

SAFETY BOTTLE HOLDER.—H. KANNELL, 1029 Amsterdam Ave., New York, N. Y. This invention provides a bottle holder for use on doors, in dumb waiters, and in or on other devices, and is arranged to permit a milkman or other person to place one or more bottles into the holder to prevent removal of a milk bottle by any person except the one it is intended for, and to allow of placing empty bottles into the holder for convenient removal by the milkman or other person.

COMPASS WITH ANGULAR SHIFTING MAGNETYING DEVICE.—H. E. COLOMBEL, 5a Rue de Moscou, Paris, France. This invention has reference to mariners' and other compasses and has for its object certain improvements which permit to exactly mark the position of the indicator corresponding to a given direction and to appreciate with great facility the displacement of the indicator relatively to this position.

MOLD FOR WALLS.—C. H. HARRIS, Kenosha, Wis. This inventor provides a wall mold having members so formed and arranged that upon the mold being placed in position, the members will automatically assume the proper positions to form the desired space for the material to be molded, and upon lifting the mold the members will automatically be given a separating lateral movement

Heating and Lighting.

GAS LIGHTING AND EXTINGUISHING APPARATUS.—A. G. KENT-LOUGHTON, "Glendoldon," Thurleigh Road, Balham, London, S.W. England. The object here is to reduce the resistance offered to the initial movement of the pressure member on account of the excessive compression of the gas on one side thereof and to do so in such a manner that not only is the apparatus consequently rendered operable by a much smaller pressure increase, but also rendered more reliable in action than hitherto

Household Utilities.

LATCHING DEVICE.—W. P. RAWCROFT, Bostwick, Neb. This device is more particularly intended for use in connection with a swinging wringer support to hold the latter in a given position. The device will hold a wringer support or equivalent element tightly in the fastened position

GRIDDLE.—T. J. NASH, 235 N. 22nd St., Lincoln, Neb. An object here is to provide a device which is hinged along its center line and which is provided with handles for readily turning one of the sections so as to carry the article deposited upon it over the opposite section and to deposit it thereon

OPEN AIR SLEEPING BED.—ELSA C. ANDREWS, Burbank, S. D. This invention provides a bed on which the head of the sleeper may be outside and the body on the inside of the building, whereby the sleeper can gain the advantages of sleeping in the open air and the body may be protected from the cold or other inconveniences of the weather. It provides means by which part of the bed may be readily and conveniently moved out of a window or other opening in the wall and as readily withdrawn, whereby the sleeper may avoid the storms or other annoyances of the weather or surroundings

Machines and Mechanical Devices.

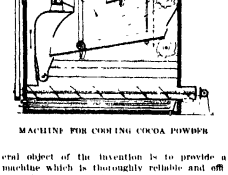
DEVICE FOR PRODUCING ALTERATIONS IN THE MOVEMENTS OF VALVES.—P. KING, Turin, Italy. This device produces alterations in the times of movements of distributing valves in power engines in which the valves for controlling the introduction and exhaust of the motive agent are actuated from a distributing shaft by means of a cam or eccentric, and the object of the inventor is to provide a mechanism for this purpose arranged between the cam and the valve to be controlled.

CAKE CLOTH REMOVER AND TRUCK LOADER.—W. J. LOWRY, P. O. Box 1193, Waco, Tex. The object in this case is to provide mechanism having means for mechanically removing the press cloth from cotton and like seed cakes, and for afterward delivering the cakes to other mechanism for loading the same on a truck or the like

VALVE.—S. BLOCK, care Weinburg, 302 Broadway, New York, N. Y. In this invention use is made of a valve normally held to its seat by a spring and yieldingly opened by fluid pressure whenever the latter exceeds the tension of the spring, an actuating device for moving the valve into open position, and a locking device controlled by the said actuating device for locking the latter against return movement to hold the valve open

STUMP CUTTING MACHINE.—A. L. MOORE and G. D. MOORE, 1736 St. Charles Ave., New Orleans, La. This invention relates to a machine for removing stumps by cutting means adapted to be lowered from above the stump, and gradually fed to the latter until the complete stump is cut away, leaving only the minor roots, the action of the cutter being such as to cause the chips or shavings to be thrown outward by centrifugal force.

MACHINE FOR COOLING FINISHED OR UNFINISHED COCOA POWDER.—M. O. BURGER, 212 Sixth Ave., Newark, N. J. This machine has to do more particularly with the cooling of the finished cocoa powder when it is reheated for the purpose of producing a darker product or for cooling the unfinished powder received from the crushers. The general object of the invention is to provide a



MACHINE FOR COOLING COCOA POWDER

machine which is thoroughly reliable and efficient in use, so designed as to have a large capacity and comparatively inexpensive to manufacture and keep in repair and operation

MACHINE FOR GRINDING ROUGH FORGED BLADES OF KNIVES AND OTHER

The Jeffery Quad

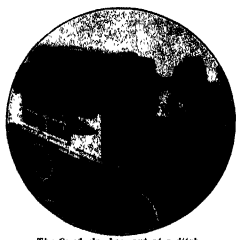




Loading 37½ M Red Cedar Shingles on a Jeffery Quad This load is easily handled



Rough work.



The Quad clambers out of a ditch



The kind of work the Army gives it



Carrying lumber to the side of the construction work



The Quad handles trailers in addition to its own load.

Power on all Four Wheels

FRANCE went to war the other day, carrying her provisions on four-wheel-drive trucks.

The same day the Parsons Lumber Company, of Rockford, Illinois, enlisted a fleet of four-wheel-drive trucks for handling lumber.

The same week there gathered at Kenosha, Wisconsin, more representatives of more lines of business than ever before attended a similar conference. They came to witness the demonstrations of a four-wheel-drive, four-wheel-steer, four-wheel-brake motor truck.

The next week 300 motor car dealers, representing practically every state in the union, assembled for the same purpose.

Every day *this* week, and *every* week, demonstrations are being held at Kenosha—attended by business and transportation experts.

Moving pictures have been taken—to be shown in every part of the country. News articles have been written—run in class publications and newspapers. Transportation specialists are turning their eyes to Kenosha, Wisconsin. Dealers are buying—and selling to their customers.

The source of this suddenly aroused interest? How has it all happened so quickly?

An Army Officer Comes to Kenosha

Two years ago an American Army Officer, in his search for more efficient means of mobilizing troops, came to a Kenosha motor car maker.

He layed before this concern the high cost and slowness of the four-mule team method of moving supplies and ammunition. He pointed out the difficulties of operating with two-wheel-drive trucks under the adverse conditions which inevitably confront troops in active service.

The name of the motor car maker was The Thomas B. Jeffery Company. The most skilled Jeffery engineers and transportation experts were put to work on the problem. The result was the Jeffery Quadruple Drive Truck—now already beginning to be widely known as the Jeffery Quad—a four-wheel-drive, four-wheel-steer, four-wheel-brake motor truck.

The United States Government has been using the Quad for over a year in its Commissary and Aeroplane Corps. The Government is satisfied.

War, the destroyer, has been instrumental in developing a machine destined to become a vital factor in the progress of peace. Military necessity has given rise to a new high water-mark of efficiency in commercial motor trucking methods

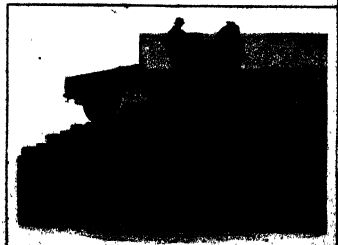
Business Gets the Benefit

The armies of the world needed four-wheel-drive motor trucks.

The Parsons Lumber Company and all business concerns with heavy hauling problems get the benefit. You get the benefit if you have heavy hauling to do. You get lower costs—greater speed in handling. You get a strategic advantage over competitors.

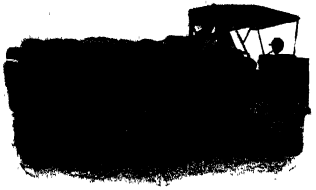
The oil producers of California are using Quads to pull their heavy-laden trailers over bad stretches of road. Mining concerns are buying. Quads are at work here and there through the great grain regions of the Northwest. Lumber dealers, department stores, wholesalers, city fire departments, brewers, coal merchants, contractors and builders—all businesses which do heavy hauling—are welcoming the Jeffery Quad.

Dealers are stocking up—already making sales.



Taking its load up a 49% rough grade.

Will go anywhere a Four Mule Team can go

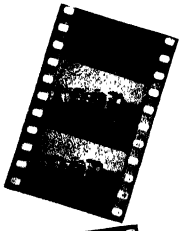


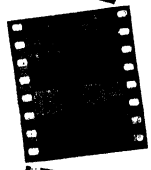
Quartermaster's supplies on a sandy road



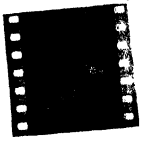
Hear it going

Moving Pictures show the remarkable performance of the Quad









Built to meet the U. S. Army Specifications for a truck that will take its load "anywhere four mules can go." Drives, brakes, steers, on each of the four wheels

The Jeffery Quad goes anywhere where a four-mule team can go—through the deepest mud, over the steepest hills—carrying two tons and more on its back plus eight or ten tons on trailers. It pulls out of an excavation where the ordinary motor car or horse team cannot possibly move a load. The forward wheels climb while the rear wheels push. It accomplishes tasks that look impossible—does them easily—and *economically*.

Look at the Pictures on These Pages!

They are tame compared to the actual first-hand sight of the truck at work. But they serve to illustrate.

First the truck speeds up 200 yards—going 14 miles an hour—then stops within eight feet. Irresistible brakes, applied on all four wheels and drive shaft, are the secret.

Picking up quickly, the Quad takes a series of three 16-inch hurdles, built of heavy planks piled one on top the other, presenting a perpendicular front.

A quick turn follows. All four wheels, actuated together, co-operate. Forty-two feet is all the space required for the complete turn.

From here the driver steers into a plowed field, where at times the mud is so soft the wheels sink in to the hubs. The Quad pulls through steadily without even hesitating.

Through this field there is a deep ditch, the sides of which form an angle of 45 degrees. The front wheels let the truck down into the hollow, then begin to climb the other side. The back wheels push. The Quad pulls out easily. It backs down in again; the rear wheels climb backwards, the front wheels push now. The task is done backwards with as great facility as forwards! Water in the ditch to a depth of 34 inches is no hindrance.

The last test of the series is the most spectacular. The driver approaches a 49% grade—lumber, piled in irregular steps. The Quad climbs. Holds itself at any point. Goes to the top. Backs down safely!



Ready for the Army.

The Meaning in Dollars and Cents

Your trucks will never have to climb piles of lumber. They probably will not have to negotiate deep ditches, nor travel over soft plowed fields.

But they do frequently have to travel over bad roads, through mud holes, and up steep hills. They meet with much rough going. Many times you ask them to bear heavier burdens than they can carry. Many times you wish they could pull heavier loads on trailers. Many times you spend money on slow, inefficient methods of hauling—you use horses and mules—because you haven't been able to get trucks that could do the work. Many times you lose business; you lose money because of delays—because your transportation facilities are *too slow—too uncertain*.

Read the Story of the Jeffrey Quad

Read it *now*—whether you are in the market or not. Read this story of achievement. It will be sent you free of charge—in answer to your signature on the coupon.

Read how the Jeffery Quad has won its efficiency, not through increased weight and expense, but through superior construction and engineering skill—how its tremendous power is generated by a small, light, high-speed power unit of the type made famous by Jeffery—how the wheels are turned by an internal spur gear applied, not on the hub but at a point half way to the rim, giving a powerful leverage—how the very slight excess in gasoline consumption is more than offset by the saving on tires—how the Jeffery Quad enables business men to solve their trucking problems at *low cost*.

Read the story *now*.

Post yourself NOW on this Ultimate type of truck

The booklet will be sent you free of charge—without obligation. We want the business men of this country to know and appreciate the Jeffery Quad. We are glad to furnish you with the facts.

What the Jeffery Quad Does

Pulls with all four wheels
Brakes on all four wheels and drive shaft
Steers on all four wheels
Carries two tons on its back
Hauls ten tons on trailers
Clambers over 16-inch hurdles
Goes through mud up to hubs
Travels through water 34 inches deep
Climbs out of ditches
Takes a 49% grade with load
Turns within 42 feet
Does its work with a small low power motor
Economizes tires
Costs but $2750



The Thomas B. Jeffery Company also makes high-grade rear axle drive trucks which have given unusual satisfaction in many lines of business—a three-quarter ton and one and a half ton truck at $1,300 and $1,650 respectively. Complete body department maintained

The Thomas B. Jeffery Company

Main Office and Works, Kenosha, Wisconsin

CUTTING INSTRUMENTS.—P. PERIGNAT, Thiers Puy-de-Dôme, France. This invention has for its object to provide a machine for grinding the rough forged blades of knives and other cutting instruments however irregular their shape and whatever their dimensions. The machine may be employed, also, for grinding sword blades, razors, pocket knives, surgical instruments, and generally all instruments having cutting blades.

BRACE FOR DRILLING MECHANISMS.—J. M. HATFIELD, 408 W. Mulberry St., Robinson, Ill. The more particular purpose here is to provide a brace for use in connection with drills for the purpose of preventing displacement of the circle or track relatively to other parts used in connection with wrenches, for the purpose of securing together the drilling stem and bit for discouging the same.

TRAVELING IRRIGATOR.—J. C. SEARLE, care of Hind, Rolph & Co., 310 California St., San Francisco, Cal. This invention provides a machine preferably of a self-propelled nature, which is adapted to draw or to receive water from a ditch while progressing along or over the same, the machine being provided with

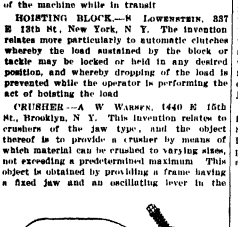


TRAVELING IRRIGATOR.

pumps or other suitable machinery whereby the water will be elevated and distributed over a wide portion of land on either or both sides of the machine while in transit.

HOISTING BLOCK.—S. LOWENSTEIN, 337 E. 12th St., New York, N. Y. The invention relates more particularly to automatic clutches whereby the load sustained by the block or tackle may be locked or held in any desired position, and whereby dropping of the load is prevented while the operator is performing the act of hoisting the load.

CRUSHER.—A. W. WARREN, 1440 E. 15th St., Brooklyn, N. Y. This invention relates to crushers of the jaw type, and the object thereof is to provide a crusher by means of which material can be crushed to varying sizes, not exceeding a predetermined maximum. This object is obtained by providing a frame having a fixed jaw and an oscillating lever in the



CRUSHER.

frame having a jaw adapted to coact with the fixed jaw of the frame, the said lever being adjustably mounted in said frame and adapted to be reversed in the same. Furthermore, the means for actuating said lever are so connected to the same as to prevent a rupture in any of the moving parts of the crusher when an object of high resistance is located between the crushing jaws.

Musical Instruments.

PIANO HAMMER.—J. C. MILLER, 1601 S. 26th St., Lincoln, Neb. This invention relates to improvements in piano hammers, and an object of the inventor is the provision of a device by means of which the striking surface may be readily adjusted or renewed, or changed in its contour or texture.

Prime Movers and Their Accessories.

ENGINE STARTER.—H. W. BACHELDER, Herkimer, N. Y. This improvement has reference to internal combustion engines, and its object is to provide a new and improved engine starter arranged to permit an automobile or other vehicle to quickly and readily start the engine without resorting to cranking.

PISTON BEARING.—J. E. ERSKINE Address G. Lenberg & Co., 119 N. 3rd St., Louisville, Ky. Mr. Erskine's invention provides a bearing, for connecting a piston or plunger with the crank shaft, so arranged as to permit a universal movement of the piston with respect to the rod, and a thorough lubrication of the bearing, and of the piston.

STARTING DEVICE FOR INTERNAL COMBUSTION ENGINES.—W. V. GILBERT, Address Day, Davies & Hunt, 321 High Holborn, W.C., London, England. Mr. Gilbert's invention is a starting device for internal combustion engines used on motor cars, aeroplanes and the like, in which it is necessary to cause an initial turning or revolution of the engine shaft or the like otherwise than by its own motive power.

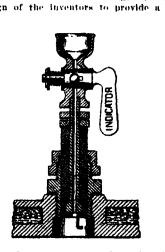
ENGINE STARTER.—F. MISKOVSKY, 38 Mento Ave., N. Lynn, Mass. The invention relates to an apparatus for starting automobiles or other engines, and it relates more particularly to a starting device in which a single actuating means in the first part of its movement relatively connects the starting shaft with the crank-shaft of the engine, and during the remaining part of its movement causes the starting shaft to rotate the crank shaft sufficiently to enable the engine to start.

INTERNAL COMBUSTION ENGINE.—G. D. CASSON and F. D. BLAKELY, 812 Confederation Life Bldg., Winnipeg, Manitoba, Canada. This invention comprises certain improvements in valve constructions for internal combustion engine motors, by means of which the entrance of the combustible gaseous mixture to the firing chamber and the discharge of the burnt mixture after explosion from the firing chamber can be more advantageously controlled.

ROTARY VALVE.—E. B. HANSOM, Sta. B, A. T. Nashville, Tenn. The intention here is to provide a rotary valve arranged to cover the admission of the explosive mixture and the exhaust of the products of combustion in such a manner that the timing of the explosion is accurate and carbon deposits are prevented.

BEARING.—A. BONOM, Paterson, N. J. This invention pertains to bearings of the pedestal type, and has reference more particularly to turbine shaft bearings. An object is to provide a bearing having means whereby the journal therein is automatically oiled. Also to provide a bearing that will accommodate concentric shafts adapted to rotate in opposite directions and which will automatically oil the journals of both shafts.

COMBINED SPARK PLUG, PRIMER, AND INDICATOR.—A. P. SEISS, 1104 South 13th St., Omaha, Neb., and G. W. ROBBIG, Council Bluffs, Iowa. This invention relates to spark plugs for internal combustion engines, and it is a design of the inventors to provide a spark



COMBINED SPARK PLUG, PRIMER, AND INDICATOR.

plug and appurtenances which, in addition to the usual functions of the plug in producing the ignition spark, will serve as a primer and also serve to indicate whether a particular cylinder is doing its work, or doing it properly.

INTERNAL COMBUSTION ENGINE.—E. H. SCHATTUCK, Granby, Hartford Co., Conn. This invention relates to an improvement in internal combustion engines, and particularly the valve gearing on such engines, by which the inflow and outflow of the gases of such engines are controlled; and the primary object thereof is to produce an engine of this type which will be perfectly noiseless in operation and be characterized by a smaller number of parts than prior motors of this type.

GRINDING TOOL FOR GAS ENGINE VALVES.—C. L. BALDWIN, care of Dr. Merle Casey, Almond, Wis. An object of this improvement is the provision of a hand tool having a valve-engaging head connected with a stem or shaft to which rotation is imparted by one hand of the operator through suitable means, while pressure is exerted through the tool on the valve by the other hand, so as to hold the valve in grinding relation to its seat.

Railways and Their Accessories.

RAILROAD TIE.—G. H. STRAND, Lincoln Co., Merrill, Wis. This improvement provides a railroad tie constructed of two resilient slotted members engaging each other at the slots, and each having two ends, one of the ends of each of the members being rolled and disposed within the other turned back end of the other member on which the rail rests.

SPLICE BAR.—W. J. SMITH, 1501 Gaty Ave., E. St. Louis, Ill. This invention provides an attachment for securely joining the meeting ends of rails, without the use of bolts or the like passing transversely of the rail, and wherein mechanism is provided for securely anchoring the rail ends in alinement, to the web, without requiring any transverse opening in the rail or the connecting means.

PREHEATER.—G. H. WILSON, Orchard Ave., Spokane, Wash. This invention relates to feed-water preheaters for locomotive boilers. The aim is to provide a tubular preheater which may be easily cleaned and which will utilize the heat of the hot gas entering the smoke box, as well as that of the exhaust steam.

CAR COUPLING.—C. H. KADIE, Strasburg, Va. This invention relates to couplings of the general type known as Master Car Builders' automatic couplings, the general purpose of which is to reduce to a minimum the dangers peculiar to the coupling of cars and also to save time in coupling. This is accomplished by rendering the coupling more efficient, reliable, safer, and more convenient to operate, and to obviate the necessity of a person going between the cars for coupling and uncoupling.

Pertaining to Recreation.

CAROUSEL.—P. RYAN, 347 E. 30th St., New York, N. Y. In this carousel horses or seats are caused to have traveling movement through a given path, and the invention relates particularly to an apparatus having means for supporting the seats and their propelling means on a traveling vehicle, preferably motor-driven, whereby the carousel may be transported from place to place, and be ready for immediate operation.

Pertaining to Vehicles.

AUTOMATIC FENDER.—B. PEDUCASSE, care of N. Delorme, 71 W. 23rd St., New York, N. Y. This invention relates to an automatic fender for motor vehicles, and the like, which is adapted to be extended automatically by the impact of a person on the vehicle or by manual means operated by the motorman. The device is inexpensive to make up and easily operated.

VEHICLE WHEEL.—T. FITZ E. HUTCHISON, 218 W. 58th St., New York, N. Y. Among the principal objects which the present invention has in view are: to provide a tire rim and tire removable from, and attachable to, the felly rim of a wheel; and to provide means for rapidly removing and replacing rims and tires of the character mentioned.

REAR SIGNAL FOR VEHICLES.—M. E. WALSH, 177 Adelphi St., Brooklyn, N. Y. This invention provides a signal apparatus readable at the rear of a vehicle to show the purpose of the driver of the vehicle; provides an operating mechanism for a signal, which is simple and efficient; and provides operating means for the apparatus, to avoid interference of the various signal devices, and to secure a desired precedence of the signals.

ILLUMINATED INDICATOR.—SAMUEL W. BROWN and W. R. MICHAEL, Address the former, 232 N. Custer Ave., Colorado Springs, Colo. This invention relates to improvements in illuminated indicators as used on rear ends of vehicles, and has reference more particularly to a device comprising a telescoping casing carrying the indicator, and a lamp associated with the casing for illumination of the indicator.

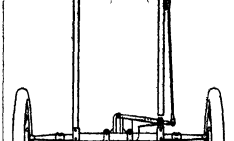
TRACTOR WHEEL.—J. BEARD, Knowles, Cal. This improvement refers to a self-laying track for tractor wheels. It provides a track of the character that the tractor wheels may more readily mount obstructions in the road, and so constructed as to minimize the possibility of picking up trash, sand, etc., from the road.

STEERING APPARATUS.—S. JACOBSON and P. E. ANDERSON, Lyncli, Neb. In this case the invention is an improvement in steering apparatus for carts and the like, wherein mechanism is provided operated by the feet of the driver, for simultaneously swinging the wheels on a vertical axis, to steer or guide the vehicle.

WHEELED SCRAPER.—W. H. VIOLETT, Rifle, Colo. This invention relates to wheeled dumping scrapers of the class in which the scoop is connected with a crank axis and the latter operated by a lever for the purpose of vertically adjusting the scoop, and the object is to provide draft connections whereby the scoop may be raised after being filled without necessitating manual use of the lever hereinmentioned.

AUTOMOBILE CLOCK.—H. STRAUB, Brooklyn, N. Y. This invention provides novel winding and setting mechanism for time movements whereby keys and pendants may be dispensed with, such winding and setting mechanism embodying a ring which when turned in one direction sets the hands, and when turned in the opposite direction winds the spring, only one of such mechanisms being in gear at the time, the other being automatically thrown out of gear.

SAFETY CRANKING DEVICE FOR AUTOMOBILES.—A. J. ZLOTOREVNESKI, 1001 E. Race St., Shamokin, Pa. This inventor provides a device which has a U-shaped member for engaging the crank, the U-shaped member being connected by a lever and rod with the clutch lever of the automobile. When the clutch lever is



SAFETY CRANKING DEVICE FOR AUTOMOBILES.

in neutral position the U-shaped member is held out of engagement with the crank, but the movement of the clutch member into operative position, throws the U-shaped member by means of the first lever and the rod into position to embrace the crank and prevent its rotation.

COMBINED AIR COMPRESSOR AND MOTOR.—D. E. CROUSE, C. G. EDISON, and T. DAVIS, care of Auto Air Appliance Co., Industrial Bldg., Baltimore, Md. This device may be used either as a means for compressing air or as a motor. It is particularly adapted for use as a starting device for automobiles, and also as a means for compressing air for driving the starting device.

Designs.

DESIGN FOR RIBBON, AND PARTICULARLY FOR BROCADED WOVEN RIBBON.—J. W. MACLAREN, and E. SPECK, care of Johnson, Gowdin & Co., 126 Fifth Ave., New York, N. Y. This ornamental design for a ribbon represents a band of fabric adorned with widely separated flowers on a stem and with leaves.

VANITY CASE.—A. BIENSEMUCHT (Biensemucht Bros.), 109 Spring St., New York, N. Y. In this design the form is oblong with rounded corners, the edge comprising an ornamental twisted cord, which also runs across the center. A small mirror is attached at the upper portion.

ORNAMENTAL DESIGN FOR A RAIN COAT.—N. M. BUSH, care of Edward McConnell & Co., 13 E. 22nd St., New York, N. Y. In this ornamental design for a rain coat the garment is buttoned at the sides. A hood surmounts the coat which is plain in front. The back is belted and the sleeves form a cape effect at the back.

DESIGN FOR A BUTTON.—J. F. BYRNE, care of City Button Works, 374 Second Ave., New York, N. Y. In this ornamental design for a button the article is of oblong shape, and its plan view, side elevation, and end presentation show a button of attractive and graceful lines.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for 10 cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Notes for Inventors

A New Way of Fastening Cardboard Boxes.—Packing cardboard boxes by the use of cord is very likely to spoil the box by making grooves at the edges. There has appeared on the market a clever device in the shape of a small metal angle-piece of very light weight. The piece has two stamped points for holding it in place when slipped on the edge of the box, and a groove in the corner of the metal serves to hold the string and keep it from slipping. One of these pieces is put on wherever the string meets the corner of the box, and it thus acts to prevent any damage to the latter.

Making Wood Out of Straw.—If we are to believe the *Monsieur des Sciences*, wood can now be made out of straw, this being a real wood without grain or knots which can be sawed as usual and also turned in the lathe. The "wood" is molded in the shape of plank, lath and round sticks. In the process which is said to be used in France, straw is cut by machine and then reduced to paste by a heating process, employing chemical products whose nature is not exactly known, but probably caustic soda is used here. The paste is then compressed in molds of suitable shape. Such product is of the hardness of poplar wood, and can be worked as easily. It burns like real wood but gives a large flame and little smoke, so that it will find a use in the match making industry. It will also be very good for making light and strong packing boxes, so that these two applications will already assure it a wide use in the industry.

Patents in India.—U. S. Consul Henry D. Baker, of Bombay, advises American manufacturers who contemplate selling many devices susceptible of imitation in India to take out patents in that country, and says, "It is not at all uncommon for Indian native dealers to order from other countries a particular article or machine, not with the expectation of importing it in the future, but merely to study it and locally manufacture copies of same."

A Montessori Educational Device.—Maria Montessori, of Rome, Italy, has secured U. S. patent, No. 1,103,369, for an educational device involving didactic material for instruction of children, in which a number of units bearing designs having roughened surface upon which the ball of the child's finger operates, are utilized.

An Electric Wrench.—Eugene Woodland Burroughs, of Norfolk, Va., in a patent, No. 1,102,240, provides a wrench especially adapted for use in connection with railroad tracks for operation by an electric motor.

An Advertising or Displaying Device.—In a patent, No. 1,102,270, Charles Lowell Howard, of Washington, D. C., shows an advertising spectacular or decorative device in which a flag is given such motion as is produced by a natural current of air.

Bed Clothing Converted into a Garment.—Ida Marie Maximiliane Ernestine Hubner, of Dresden, Germany, has patented, No. 1,102,408, a coverlet for a couch, cot or bed, chiefly for hospitals, sanitariums, etc., which can be utilized to cover the patient when recumbent, or as a garment to be worn by the patient when he rises from the bed.

Preventing Moths in Wardrobes.—A wardrobe has been patented, No. 1,097,844, by Clyde J. Coleman, of New York city, for protection against moths by displacing the air in the wardrobe automatically and filling the wardrobe with a non-respiratory gas upon the closing of the door.

An Elihu Thomson Spot-Welder.—In patent No. 1,097,895, to the Thomson Electric Welding Company, as assignee of Elihu Thomson, is shown an apparatus by which to secure a spot-welding, for instance, of two sheets of metal, by simply feeding the same between two wheels, rolls or disks, welding electrodes being suitably provided.

An Illuminated Deceptive Advertising Device.—A patent, No. 1,097,922, for the invention of Frank H. Feraud, of Granite City, Ill., assignor to Edward S. Briggs, of St. Louis, Mo., presents an illuminated sign embodying a large plate of glass bearing a lamp, and in which the problem is as to the source of the current for the lamp.



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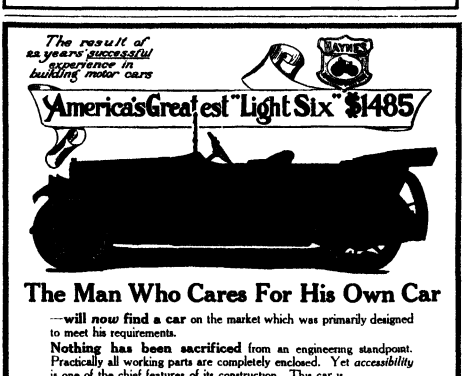
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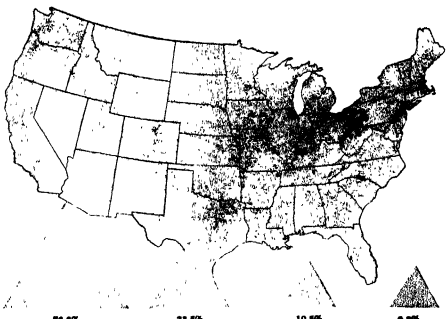
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What the Telephone Map Shows



EVERY dot on the map marks a town where there is a telephone exchange, the same sized dot being used for a large city as for a small village. Some of these exchanges are owned by the Associated Bell companies and some by independent companies. Where joined together in one system they meet the needs of each community and, with their suburban lines, reach 70,000 places and over 8,000,000 subscribers.

The pyramids show that only a minority of the exchanges are Bell-owned, and that the greater majority of the exchanges are owned by independent companies and connected with the Bell System.

At comparatively few points are there two telephone companies, and there are comparatively few exchanges, chiefly rural, which do not have outside connections.

The recent agreement between the Attorney General of the United States and the Bell System will facilitate connections between all telephone subscribers regardless of who owns the exchanges.

Over 8,000 different telephone companies have already connected their exchanges to provide universal service for the whole country.

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An Automobile Radio-telegraphic Station for Field Use

(Concluded from page 235.)

bipolar interrupter, a bipolar circuit breaker, and two safety lamps connected in series between the terminals of the alternator, with the wire between the lamps connected to earth.

For sending wireless messages the station employs an alternating current of 500 cycles, which produces a loud, pure, and constant musical tone. The primary circuit of the sending apparatus is greatly damped by the employment of a divided discharger, which can be regulated with great precision. When the antenna is excited in this way it sends out waves of uniform length which are very easily tuned. As is well known, this uniformity in length of the aerial waves depends only on the damping of the exciting circuit, is entirely independent of the nature of the connection, and does not require the circuit to be tuned to exact syntony with the antenna. The wave-length may then very gradually within wide limits without affecting the transmission of messages. The wave-length can be changed very easily without re-tuning the circuit and the antenna. The energy transmitted to the antenna can be modified very quickly by regulating the sparking distances. This is accomplished by means of a micrometer screw, which acts on all the spark gaps simultaneously.

The discharger is so designed that the discharges are almost silent, a condition which is particularly desirable for a military field station in war.

The sending apparatus comprises:

1. An oscillating circuit composed of condensers, a discharger, and a resonator.
2. A key having copper contacts immersed in petroleum oil.
3. A rheostat by which the load on the alternator can be kept constant during transmission
4. A commutator by which the antenna can be instantly disengaged from the sending apparatus and connected with the receiving apparatus, or conversely, by a single movement
5. An amperemeter which indicates the amount of energy transmitted to the antenna.

The receiving apparatus includes a combination of condensers and resonators which has very little damping, and greatly facilitates the elimination of stray waves. The variable condensers contain no dielectric except air, while the coils are of minimum ohmic resistance and are arranged so as to produce the minimum mutual induction This combination presents great advantages for the reception of waves of little damping, although its efficiency is not diminished when less syntonizable waves are received. Two definite receiving positions have been adopted: a position of expectation, which is most suitable for rapid exploration of the Hertzian field; and a position of syntony, which makes it possible to obtain great sensitiveness and to eliminate disturbing waves. The station can be adapted to receive signals of any wave-length between 200 and 2,500 meters.

A dynamo and accumulators for electric lighting, and a number of non-electric emergency lamps complete the equipment of this automobile wireless station, which is as remarkable from the mechanical point of view as it is from that of wireless telegraphy.

Time as a Factor in Baseball

(Concluded from page 239.)

the batter, hitting at an unexpected "fast one" will make a foul (if he hits it at all) more often than anything else. He hits so that his bat meets the ball behind him, not beside him, and it angles off to right or left beyond the foul lines. But when Frank Baker does bring those mighty shoulders against one of Walter Johnson's fast balls—why then it's a home run over the fence!

If further proof is needed, it is found in the amazing fact that the best "arms" in the business can throw a ball farther than the most powerful batter can bat a ball tossed—not pitched—in the air. The record throw is 426 feet 9½ inches, made [illegible] a player [illegible] the ball [illegible] the air by a [illegible] [illegible] inch, made by [illegible] [illegible]. There is no record of how many [illegible] longest fly batted from [illegible] but an excellent record. A small boy outside the fence always makes off with the ball before an over-fence home run can be measured! It is probably well over 500 feet.

At the rate of 120 feet a second it takes one half a second for the ball to get from the pitcher's hand to the batter at the plate. It is the fact that this time is so small, which accounts for much of the pitcher's power over the batter. Half the time a pitcher "fools" a batter it is not because the latter didn't *see* the course of the ball or note that the ball was a "shoother" (one pitched slowly), but because there wasn't *time* for his "nervous reaction" to work between his recognition of the fact and the instant he must act on his knowledge. A "floater," for instance, "looks like a balloon," as the player says. The ball seems *big*—he can see the seams on it. If he knew it was coming before it left the pitcher's hands, he could—and probably would—knock it over the fence. But he has expected a curve or a "fast one." His muscles are all "set." The shoulder muscles tighten and the swing commences almost as the ball leaves the pitcher's hands. Suddenly, when the ball is almost upon him, the batter sees it is "big" and "slow." But that swing is started. The mind has been made up. The brain has telegraphed its instructions. Spite of his will, the bat swings—and after it has passed over the plate, the ball passes lazily by the batter into the catcher's mit.

"Psychology," says the professor.

But it actually is *time*—time and balance between distance, between speed of batted ball and thrown ball, between speed of mind and speed of muscle. While this balance is left undisturbed, baseball will always be uncertain—always be a contest and always have that fascination for the "fan" that it has now—the uncertainty and the hazard epitomized for generations of ball players and fans alike in the aphorism,

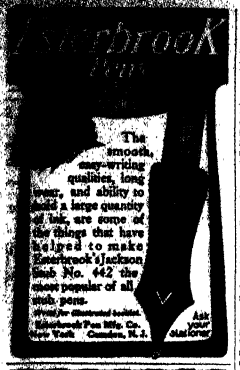
"You never know the winner till the last man's out!"

Switzerland Asks for Help

THE little Republic of Switzerland is making an appeal to the world for help, for she has been reduced to dire straits by the terrible European war that is being fought on her borders; and while the appeal is addressed particularly to her children who are enjoying peace and prosperity in other lands, she also seeks assistance of the many friends who have enjoyed her hospitality in other years.

As a result of the hostilities on her borders Switzerland has been obliged to mobilize her entire army of 800,000 men, not for offense, but solely to defend her neutrality, at an expense of $230,000 a day, while her entire revenues amount to only $16,000,000 a year. This heavy expense has not only depleted her exchequer, but with all her able-bodied men in military service her industries are at a standstill and her harvests have had to be left to the feeble hands of the aged, the women and children. The result is that thousands of families are now without the bare necessities of life.

In making this appeal the fact is recalled that Switzerland is the mother country of the Red Cross, and moreover, notwithstanding her own distress, she has offered to become the hospital for the warring nations and to do all in her power to alleviate the sufferings of those injured in battle; and these things should open the hearts of humanity to assist her not only to carry out her charitable purpose, but to relieve the distress of her people. Contributions should be sent to Swiss Relief Fund, 241 Fifth Avenue, New York, where subscription lists can also be obtained. The necessities and unmerited suffering of our little sister republic should appeal to the sympathies of all Americans.



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(13018) J. H. I. asks: Can you give me a good formula for carbonizing the tops of tables (wood), and commonly called black acidproofing? If you have no such formula, can you tell me how I can get same? A. You will find a process for a black finish for table tops in our SUPPLEMENT No. 1431, which we have used upon oak laboratory tables with fine results. We will send the paper for ten cents.

(13019) A. L. asks: Will you please explain the undulatory theory of light, and also the theory of emission? Which is more generally accepted? A. The emission theory of light assumes that tiny particles are shot out from all bodies which we can see, and that these entering the eye enable us to see the object from which they come. The undulatory theory assumes that bodies excite waves, which traverse space as waves move over the surface of the water, and that these waves enter the eye, causing vision. These two theories existed together until about 1800, when Fresnel produced the interference of light by apparatus, and thus demonstrated that light is due to a wave motion. The believers in the emission theory had, for about two hundred years, asserted that light waves would interfere and produce darkness by their interference, if light was due to waves. When the dark bands were actually produced by the interference of light, the case was proved that light is due to a wave motion. You can see these dark bands by closing one eye and holding the hand close over the other eye, so that you can see through the narrow space between two fingers looking toward a window. You will see numerous dark lines parallel to the edges of the fingers. These are caused by the interference of the waves of light in passing the edges of the fingers. There are now none left to advocate the emission theory of light. It is dead.

(13020) E. H. C. asks: On page 29 of the fourth edition of Ball's "Mathematical Recreations and Essays," I find the following: "Here is another simple question to which not unfrequently I have received incorrect answers. One tumbler is half full of wine, another is half full of water, from the first tumbler a teaspoonful of wine is taken out and poured into the tumbler containing the water, a teaspoonful of the mixture in the second tumbler is then transferred to the first tumbler. As a result of this double transaction, is the quantity of wine removed from the first tumbler greater or less than the quantity of water removed from the second tumbler." Nineteen people out of twenty will say it is greater, while this is not the case." If it is inconceivable that an authority of this weight should have made a misstatement in a book of this character and that it should have passed unchallenged through four editions. Yet it would seem to me to be a indisputable fact that inasmuch as the second transfer is made up of a mixture, the introduction of any portion of a second element—no matter how infinitesimal the quantity—necessarily means the exclusion of a corresponding amount of the first element. I cannot see it in any other light. Will you have the kindness, as briefly as you may see fit, to straighten me out? A. The difficulty in Ball's famous puzzle lies in the indefiniteness of the statement of "quantities." This may easily be removed. Let us assign some definite quantity to each glass, say 9 spoonfuls, and carry the transaction through. It will be more easily followed if put in tabular form.

	Glass of Wine.	Glass of Water.
First step	9	9
Second step	8	9+1=10

Note.—The teaspoonful of the mixture which is returned to the glass of wine contains 1/10 teaspoonful of wine and 9/10 teaspoonful of water, so that the two tumblers contain after the second transfer:

	Wine.	Water.	Water.	Wine.
Third step	8 1/10	9/10	9	8 1/10

9/10 of a spoonful of each liquid has been transferred from each glass to the other, and the statement of Prof. Ball is correct. Of course the result would be the same whatever the numbers named. We assumed 9 simply because it gave tenths in the final result.

(13021) C. A. C. asks: I have often been told that corn meal ground on a stone is a better grade than that ground on a steel burr mill. Is this true, and if so, what is the difference? A. The housewife in our family says it is true that corn meal ground on a stone is better than that ground in a steel mill. The reason given is that the meal ground with stones is finer and more uniform.

(13022) D. L. M. asks: Would like dry air for photo dark room. A. It will not be possible to have the air of a photographic dark room dry, unless water is excluded from the room. Even then some dryer would be necessary. Several pans of fresh unslaked lime around the room will be the cheapest and simplest mode of absorbing the moisture from the air. Even then the air would not remain dry with a person in the room. We cannot reach moisture in the breath.

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etc., etc. etc.

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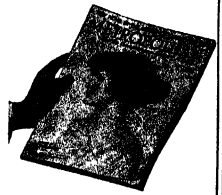
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IF YOU learned to love "Queed" and have lost yourself in the joyful pages of "V.V's Eyes," Harrison's new novel, **"Angela's Business,"** is for you. It begins in the October

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"The Livest Magazine in America"



"Angela's Business" repeats all the charm and humor of the earlier books. But this time Mr. Harrison has written a love story so original and ingenious in its plot—and so important—that you will follow it with the piqued interest of a riddle. And it will set women readers by the ears.

A young author starts out, with all the enthusiasm of youth—and lack of experience—to solve the great mystery of Woman and her Destiny. At the very outset of the quest, he himself falls headlong into his problem and all because of two real women, whose contrasted types send his heart groping as well as his head. Of course he falls in love; of course he wins a woman.

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A great American story of today is "Angela's Business," told with the charm of Locke and the shrewd insight of Bernard Shaw.



Here are a few of the interesting features in the October Metropolitan:

Really big fiction by Booth Tarkington; W. W. Jacobs; Larry Evans; Earl Derr Biggers, and the first of a series of great double-barrelled detective stories by Max Pemberton and G K. Chesterton.

Live Features

"The Correspondent and the Englishman," by John Reed (Metropolitan's war correspondent now in Europe).

"The United States of South America," by Granville Fortescue.

"What I saw in Liege"—An eye witness' story.

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NEW BOOKS, ETC.

Eugenics. Twelve University Lectures. By Morton A. Aldrich, William Herbert Carruth, Charles B. Davenport, Charles A. Elwood, Arthur Holmes, W. H. Howell, Harvey Ernest Jordan, Albert Galloway Keller, Edward L. Thorndike, Victor C. Vaughan, Herbert John Webber, Robert H. Wolcott. New York: Dodd, Mead & Co., 1914.

The value of these lectures, selected from among a number given in various universities and colleges throughout the country in the scholastic year of 1912-1913, lies not so much in any new facts which they bring out as in the singular unanimity which exists in the minds of scientific men working in widely different fields on the value of eugenics. When zoologists, physicians, physiologists, sociologists and psychologists agree on the enormous influence exerted by heredity in shaping the destinies of human beings, eugenics pass out of the realm of theory into that of fact. The more widely books and collections such as this are read, the sooner will the public consciences be awakened to the necessity of passing appropriate legislation. Eugenics in the Mendelian sense of the term is hardly ten years old, yet in that brief span much valuable work has been done, which must convince every right-thinking man what a menace bad protoplasm is to society. Every one of the lecturers whose work is to be found in this book is a leader in his special province, and a book by twelve leaders surely must command attention.

Crime and its Repression. By Gustav Aschaffenburg, Professor of Psychiatry in the Cologne Academy of Practical Medicine. Translated by Adalbert Albrecht, Associate Editor of the *Journal of Criminal Law and Criminology*. With an Editorial Preface by Maurice Parmelee, Associate Professor of Sociology in the University of Missouri. And an Introduction by Arthur C. Train, Former Assistant District Attorney for New York County. Boston: Little, Brown & Co., 1913. 8vo.; 331 pp. Price, $4 net.

Criminology. By Baron Raffaele Garofalo, Procurator General at the Court of Appeals of Venice and Senator of the Kingdom of Italy. Translated by Robert Wyness Millar, Lecturer in Northwestern University Law School. With an Introduction by E. Ray Stevens, Judge of the Circuit Court, Madison, Wis. Boston: Little, Brown & Co., 1914. 8vo.; 478 pp. Price, $4.50 net.

"The Modern Criminal Science Series" is a library of translated works, by means of which the American Institute of Criminal Law and Criminology are making accessible to American readers the researches and opinions of European authorities. The works listed above are volumes VI and VII of the series. Gustav Aschaffenburg is well known in Germany as a scholarly investigator who brings medicine and psychiatry to the aid of law and order. "Crime and Its Repression" presents a wealth of reliable statistics bearing upon crime and its causes in Germany. It does more. To collate such data is one thing, correctly to analyse them and to construct working principles from that analysis is distinctly another and higher achievement. The volume is replete with citations from past and present authorities, and the author deals with equal flair with views that support them, combats them or supplements them by his own keen insight and constructive genius. He discusses alcoholism, prostitution, gambling, and such kindred obsessions as lead to crime in the individual and in the offspring. Seasonal, occupational, racial, and religious factors are weighed, economic conditions are the subject of careful deliberation. He then comes to a consideration of prevention, purposes and means of punishment, and the vicious tendencies of the fixed term. Finally, he summarises the fundamental principles upon which all penal methods should be based.

"Criminology" is a lucid piece of writing which shows decided Anglo-Saxon influences. Indeed, there is danger that its simple style may blind us to the real depth of its foundations and the strength of its position. The criminal is made the subject of a painstaking examination in the light of his acts, his attitude, and the various influences of heredity and environment that have largely contributed to make him what he is. The laws then come in for their share of criticism; the theories upon which they are based are expounded and the defects of existing procedure frankly pointed out. Under "The Rational System of Punishment" crimes are classified, and an attempt made to fit the punishment to the responsibility and to make it regenerative rather than destructive.

A Primer of Higher Space. (The Fourth Dimension.) By Claude Bragdon. Rochester, N. Y.: The Manas Press, 1913. 8vo.; 79 pp.; illustrated. Price, $1.

A point in motion indicates a line; a line moving at right angles to itself indicates a rectangle; while the rectangle moving at right angles to its plane indicates a solid. The author seeks to continue this process into a fourth dimension, and to so state his facts and analogies that the most non-mathematical reader may glimpse the reasons behind the idea. With no claim on the author's part to contribute anything new to this fascinating discussion, he has justified his title. The work reprints Mr. Bragdon's imaginative allegory, "Man the Square," in which the four-dimensional theory is applied to the solution of several of life's mysteries.

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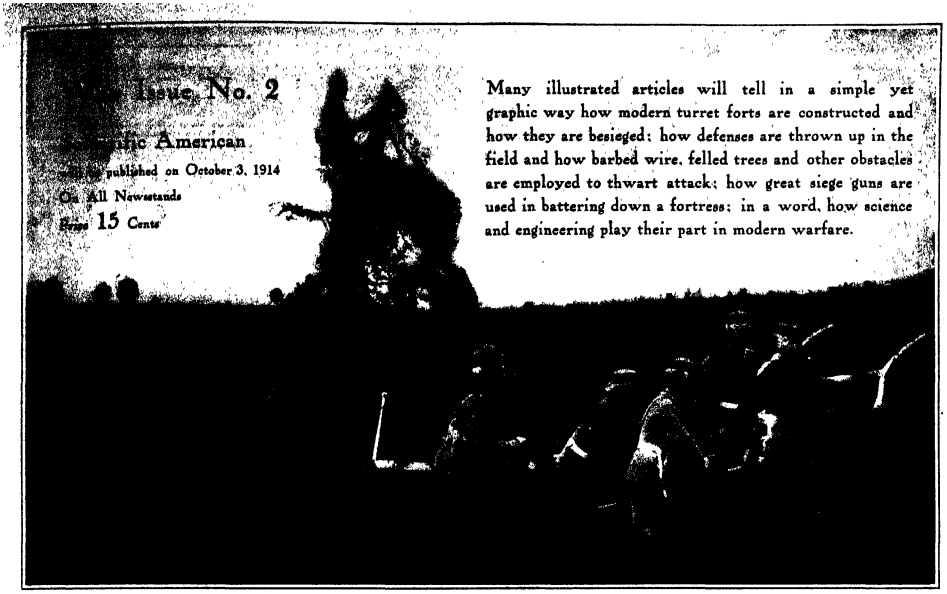
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DAY after day the Germans pumped shot and shell upon the fortifications of Liege. But the forts held out bravely. "Wait until our heavy siege artillery comes," said the Germans. When it came, the forts crumbled.

They must have been very wonderful forts that could hold out so dauntlessly, and they must have been very wonderful guns that ultimately reduced them. In the October 3rd issue of the SCIENTIFIC AMERICAN you will learn all about these forts (there are many more like them along the French-Eastern frontier), and all about the big guns that cracked them.

The Gruson Turret Fort

Military men call these Liege defenses and others of their type "Gruson Turret Forts." Curiously enough they are of German design, and fittingly enough it took German guns to reduce them.

Major A. Piorkowski, a well-known German expert on ordnance, has written, for the October 3rd issue of the SCIENTIFIC AMERICAN, a very instructive article on this Gruson Turret Fort. He takes you by the hand, as it were, and leads you through underground passages to the ammunition hoists, and eventually into the steel turret itself, and shows you its operating mechanism and its powerful weapons.

Huge Siege Guns of the Germans

The huge siege guns before which the turret forts succumbed will receive their attention in another article. In a magnificent colored cover, which will enclose the entire issue, one of these destructive giants is pictured in action. The issue will also present other pictures of siege artillery, and will explain in the SCIENTIFIC AMERICAN'S characteristically lucid way what may be expected of them.

Fortifications in the Field

How was the German onslaught met in pitched battle? Defenses of some kind, as well as gun fire, were necessary. Every obstacle that can be conceived was thrown into the path of the onrushing German infantry. The barbed wire fence and felled trees with great protruding branches must have proved formidable barricades. The full nature of these defenses, which make it as necessary for an infantry man to carry wire cutting tools as guns will be set forth.

Submarine Mines and How They Are Constructed

Perhaps a dozen or more neutral merchant vessels have been blown up by mines in the North Sea. They are terrible instruments of destruction, these mines. A tramp steamer, or a battleship for that matter, steams along through a sea that betrays nothing of the explosives hidden beneath its waves. Suddenly the ship's bottom touches the top of the mine. It is as if the trigger of a gun loaded with hundreds of pounds of deadly explosives had been pulled. The explosion is terrific; the destruction complete. How are these mines constructed? Why are they so deadly? The SCIENTIFIC AMERICAN'S war issue No. 2 will tell.

The Mechanism of a Submarine Boat

The submarine boat will also receive its share of attention; for the submarine is bound to play its part in the present conflict. As you read the SCIENTIFIC AMERICAN'S article on submarines, their intricate mechanism will be picked apart for you, as it were, just as if they were so many watches. Engines, trimming tanks, periscopes, torpedo tubes, in a word, all the wonderfully compact machinery of the submarine will be revealed.

There will be other articles too, in this issue—articles of a constructive nature.

Our Trade Opportunity

John Barrett, director of the Pan-American Union, will point out to the American exporter just what the war has done for him in opening up foreign markets that have hitherto been closed to Americans. Letters from prominent financiers, business men manufacturers, will also be published—all of them men worth heeding—whose opinions will form a fitting supplement to Mr. Barrett's exposition.

An Eight Cylinder Cadillac

The matchless mode of motoring reserved to only a few privileged persons in the Old World (at an almost prohibitive price) developed by the Cadillac Company for American motorists!

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Building and experimenting in turn, with every type from the single cylinder to the six, and from the poppet to the rotary and to the sliding valve, we have been carried forward irresistibly, by the impetus of our own research, to the highest form of frequent-impulse motor—the V Type Eight Cylinder.

It is admitted, we believe, that this Company produced in the four cylinder field, a succession of cars which earned the title "Standard of the World."

Beyond that, loomed for us only one hope and possibility—the promise of a motor in which there would be *no* lapse, *no* pause, *no* hesitation between impulses, but an overlapping of strokes so complete as to produce a flow of power almost literally liquid in its continuity.

We sought the medium by which the Cadillac would be endowed, not with *approximate* freedom from gear shifting, or *approximate* hill-climbing ability on high, or *approximately* swift acceleration, but with the *highest possible form* of these three characteristics.

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Good roads yield up a velvet quality of travel undreamed of.

Bad roads lose much of their terror, and hills seem almost to flatten out before you—so easily, so quietly, and with so little effort does the car surmount them.

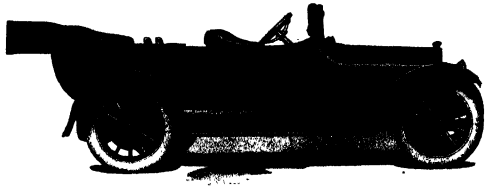
In operation, you enjoy the extreme of flexibility—from less than three miles an hour in crowded city streets and congested traffic to more than sixty miles an hour on the open highway, without change of gears.

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Seven Passenger Touring Car (illustrated) with Eight Cylinder V Type Engine.

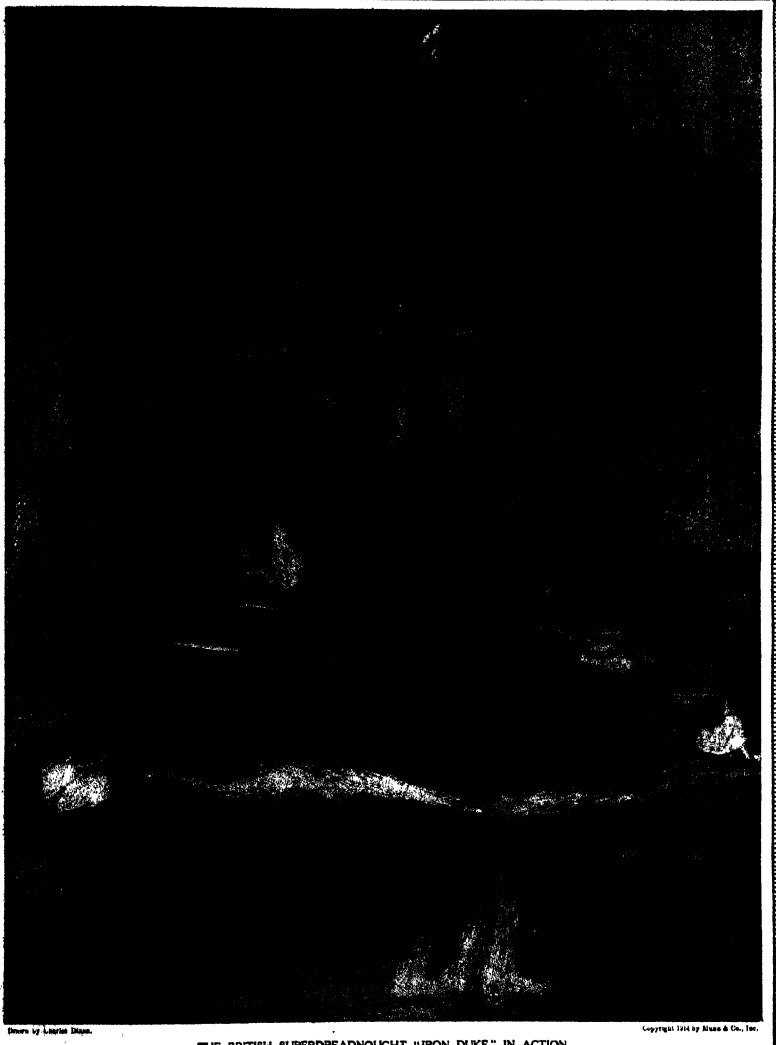
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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

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Science in Peace and in War

IT is inevitable that new discoveries in physics and chemistry should be promptly seized by military men and applied in devising death-dealing engines of appalling power. But is it necessarily inevitable that science should be more systematically applied, on the whole, to increasing the efficiency of high-powered guns than to mitigating the evils of disease and to better the general lot of humanity?

Ten years have passed since the Russian-Japanese war was fought. In that decade it is safe to say that more costly experimental investigation has been conducted to increase the efficacy of guns and explosives than to eradicate any one of a dozen human diseases for which there is at present no cure. The art of war is as old as the art of agriculture. But battleships are so rapidly improved that in less than five years the most powerful dreadnought of her day becomes a third rate fighting machine. Can as much be said of harvesting machinery?

Despite our Carnegie Institutions, our Rockefeller Institutes, our Pasteur Institutes, despite all the laboratory work done by the universities of the world, it is safe to say that more money is spent to discover new and more terrible ways of destroying human life than to preserve it. Not so long ago, the old battleship "Texas" was taken to Hampton Roads and used as a target in order to test the destructive powers of our latest battleship guns. Before that Great Britain had conducted similar experiments with the "Belle Isle." German officers with an academic turn of mind have tested Roman catapults, old guns, and the like in order to determine what progress was made in artillery from ancient days to Napoleon's time, thus completing the history of guns in a way that must cause the historians of science to sigh with admiration and envy. In 1883 and 1888 tests were made during which Gruson turrets were subjected to modern artillery fire, experiments that cost a fortune, not only in ammunition expended, but in the actual destruction of test objects. The legislatures of the world must be implored to grant comparatively small sums for conducting research which will ultimately result in bettering social conditions. A mere pittance is granted to a man like Luther Burbank, who performs the miracle of creating plants more useful to mankind than the vegetation of nature; but a prince's ransom is set aside to conduct a scientific investigation into the effect of a new explosive at a range of five miles. Advocates of eugenics do their best to arouse the public conscience to the need of race improvement, to the folly of permitting the insane, the epileptic, the socially unfit to reproduce their own kind; but the armies of the world take the flower of humanity and leave behind only human dregs.

No doubt there is a good psychological reason for this frightful anomaly. But when this hugest of wars is over, when we have counted the dead and wounded, when we have reckoned the dreadful cost in money of the millions of rounds fired, when we have tolled off the brilliant intellects that have been blotted out and that could ill be spared, and then reckon up what we have left in money and human material to continue the constructive work, so unnecessarily interrupted, will the **anomaly** be perpetuated? Will Reichstags, congresses, and parliaments grudgingly allot $20,000 to discover the cause of some new mysterious wheat blight and $100,000 to discover a better kind of bomb that may be dropped from a dirigible airship?

A Real Test of the Flying Machine in War

IF ever there was any doubt at all of the efficacy of the flying machine in war, surely the terse reports of Sir John French must have dispelled it. "One of the features of the campaign on our side has been the success of the Royal Flying Corps," writes Sir John. "In regard to the collection of information, it is impossible either to award too much praise to our aviators for the way they have carried out their duties, or to overestimate the value of the intelligence collected, more especially during the recent advance."

Sir John does not say so, but it may safely be surmised that the retreat after the battle of Mons might have been an utter rout had it not been for the air scout. With the watchful eyes in the air, it seems to have been a comparatively easy matter for the Allies to concentrate troops where they were most needed in order to permit the main body to retire in good order and take up a new position.

During a period of twenty days up to the tenth of September, Sir John French tells us, a daily average of more than nine reconnaissance flights of over one hundred miles each was maintained. The information obtained was so precise and so valuable that Field Marshal Lord Kitchener conveyed his thanks for the services rendered by the English Flying Corps.

The present conflict is not the first in which the flying machine has figured, but it is the first in which there have been real aerial encounters. Military officers prophesied that the air scout would not be permitted to reconnoiter with impunity. In the present war we have heard of at least a dozen aviators who were thwarted in their attempts at scouting by the armed aeroplanes of their opponents. On this point Sir John French's comments are illuminating. "The tactics adopted for dealing with hostile aircraft are to attack them instantly with one or more British machines," he tells us. "This has been so far successful that in five cases German pilots or observers have been shot while in the air and their machines brought to ground. As a consequence the British Flying Corps has succeeded in establishing an individual ascendency which is as serviceable to us as it is damaging to the enemy. How far it is due to this cause it is not possible at present to ascertain definitely, but the fact remains that the enemy have recently become much less enterprising in their flights. Something in the direction of the mastery of the air already has been gained in pursuance of the principle that the main object of military aviators is the collection of information."

If this means anything at all, it means that the command of the air must henceforth be attained before a modern general can hope to win a battle. Until the last air scout of his enemy has been shot, his own forces and those of the enemy must fight until physical exhaustion sets in and a point is reached where it is impossible to draw upon fresh troops. Thus may be explained the alternate advances and retreats of both sides in the present war. In the last analysis victory or defeat would seem to hinge upon the presence or absence of aerial scouts.

An American Dyestuff Industry

NINETY per cent of the dyestuffs consumed upon the world's market are manufactured in Germany or from coal-tar products made in Germany. Now that the supply to this country is cut off by the European war, an outcry is raised by a certain section of the consumers, the textile dyers, that we should have had a complete domestic dyestuff industry. From the standpoint of the consumers such an attitude seems natural and justified.

But the matter looks somewhat different from the point of view of the would-be producers. It is all very well for the consumers to say to the chemical manufacturers: "You ought to make dyestuffs; this country should not be dependent on Germany; the American chemist should prove himself the equal of his German rival." All this sounds as if a dyestuff industry should be established in this country from patriotic or philanthropic motives. In practice the motive for launching a commercial enterprise is the perhaps less poetic, but rather more practical desire to earn dividends. Whatever the consumer of dyestuffs may think about it, the prospective producer asks first and foremost: What profit is there in the proposed industry?

This is a plain question, and in reply to it let us begin by the plainest of all observations: The total imports of coal-tar dyestuffs to this country in normal times are valued at about $10,500,000 per annum. This sum is distributed over some 200 odd dyes, so that the actual value of any one dye consumed per annum is by no average something more than $11,500. Hardly a very tempting bait for the would-be producer, as pointed stated more than ten years ago. The fact is, the economic importance of the dyestuff industry has been much exaggerated. From the nature of things it must necessarily be localized, and there is just about enough of it from one country. That country, for economic (historical) reasons, is Germany, and the attempt completely to transplant the industry at short notice would never for a moment be undertaken by anyone conversant with the technical and commercial peculiarities of the manufacture of coal tar dyes.

He knows that the by-product problems pertaining to organic chemistry, which have to be met therein, are paramount and the real key to the situation. Organic reactions are much more complicated than those of inorganic chemistry. They rarely take one single and undivided course. This state of affairs greatly complicates the problem of finding an outlet for by-products, with the result that the modern dyestuff industry of Germany is one interlacing system, one great mosaic of interdependent processes and products, only a few of them of large dimensions, but all of them to-day of far-reaching effect. This necessitates not only the careful organization of each manufacturing unit, but often an exchange between separate units of some of their products. It must be remembered that the German dyestuffs industry as it stands to-day is the result of thirty-six years of untiring manufacturing and merchandising effort and development.

One influence which has been thought to be largely responsible for the absence of a domestic industry is our patent system. It has been urged that a working clause should be introduced, which would compel foreign owners of American patents to manufacture in this country. It is more than probable that those who bank any hopes on such a step as this are entertaining a fond illusion. England, Belgium, and France have had such working clauses for many years, yet they have no real dyestuffs industry. Nor is the reason far to seek. Completely fulfilling such provision without establishing a real industry has been the actual result. As an illustration, assume magenta (hydrochloride) to be patented here. The patentee sends to this country magenta *base*, which is *not* the subject of the patent. By the simple addition of hydrochloric acid thereto the magenta salt which *is* the subject of the patent is then prepared here; the working clause is fully lived up to, but no industry has been established.

If any further evidence is needed to show that the patent situation is not the cause of the German monopoly in dyestuffs, some figures collected by Dr. Hesse, the well-known chemical expert and our foremost authority on dyestuffs, speak convincingly. According to Dr. Hesse, out of a total of 921 coal-tar dyes, 407 have never been patented in the United States, and the patents on 239 further dyestuffs have expired. Only 215 of these dyes are at present protected by patents. Of those dyes which we are at liberty to manufacture only about 10 per cent are actually made here, and these very largely from imported coal-tar products not themselves dyes.

Since it seems established that a remedy is not to be found in amending our patent laws, we must look elsewhere for relief. It has repeatedly been suggested that an appropriate increase in our import duties would give the needed assistance to domestic producers to enable them to compete with the Germans in spite of all the obstacles which we have discussed. Let us apply the test of actual figures to this question. With an average annual importation of about $6,000,000 worth of coal-tar dyes for the last thirty years, we have a total importation of $180,000,000 during that period. Assuming that duties had been 10 per cent higher than was actually the case, this means that a total of $18,000,000 would have been paid as an insurance premium against the possible event of a war such as that which is now disturbing commerce. It would take at least a three years' war before this total premium alone, making no allowance whatever for interest, had been repaid by the home industry which we are supposing to have been established by the aid of the additional duty.

Substances for Paint.—The French government prohibits the use of red lead and white lead, having accorded a lapse of time which expired on July 31st, 1914. Zinc white will now replace white lead, and it is thought that red lead can be replaced by oxide of iron, although the latter is not so good. But it appears that graphite used with linseed oil will protect iron perfectly from rusting, and is much less expensive than lead or iron paint. Owing to the extensive use of graphite for many purposes, the natural product no longer suffices, but fortunately the new electric furnace processes come in to make up the deficiency.

Science

Prof. Roentgen Gives the Medal to the Red Cross.—A Berlin paper states that Prof. Roentgen does not care to retain the English medal, presented to him by the Royal Society, in recognition of his discovery of the X-ray, and has therefore given it to the Red Cross. The medal contains $360 worth of gold.

Automatic Light for Bromide Printing.—When making prints on bromide paper it is required to put on red light for loading the paper under the negative, then white light for the exposure, after which red light is again needed. A French automatic device simplifies these operations, where electric light is used. A pointer is placed on the dial at the number of seconds exposure, then the operator pulls upon a chain and the red light goes out and white light comes on for the exposure for the right number of seconds, then the red light is automatically thrown on and remains lit while the operator changes the paper for the next exposure, or until the chain is again pulled, and so on. The device is useful for making many exposures from the same negative.

The Need of a Weather Bureau in China is emphasized by Mr. C. D. Jameson in his report to the American Red Cross on the measures which his personal observations in China indicate should be adopted to ameliorate the flood and famine conditions of that country. There are at present practically no rainfall statistics for the river basins most subject to floods, much less any organization for flood prediction. Torrential rains sometimes occur in this region. In June, 1910, a local downpour in the vicinity of Sze-chow, lasting some 42 hours, is estimated to have amounted to 24 inches. The unofficial meteorological service of Zikawei Observatory, extending along the coast and up the Yangtse valley, is the nearest approach to a national weather bureau yet existing in China.

New Flash Light Powder.—Flash light powders for photographic use are generally made up of magnesium combined with a substance rich in oxygen such as chlorate of potash, but the great drawback of such powders is that they give rise to considerable smoke or fumes. Efforts made by European inventors to find a photographic powder that gives but little smoke have now proved successful, and the new "Excelsior" compound uses magnesium and oxygen-bearing substances coming from the rare earths. For this purpose, peroxide of lanthanium was chosen, and to it are added substances analogous to what are found in Welsbach lamp mantles. The whole forms a powder which is claimed to give an excellent flash light and has but one tenth the amount of smoke. The small amount of fumes dissipates almost at once in this case.

"Karluk" Survivors Reach Nome.—Word has been received, from Nome, of the arrival there of the United States revenue cutter "Bear," with eleven survivors of the Stefánsson Canadian exploring party. After their ship, the "Karluk," was crushed in the ice at Herald Island, last January, the survivors of that disaster camped on the ice for some weeks, and finally reached Wrangell Island in March, from whence this party was recently rescued by a power whaler, and transferred to the "Bear." Twelve of the original party are missing or dead, as a result of exposure, including Henri Beauchat, anthropologist; George Stewart Mallock, geologist; James Murray, of Glasgow, ocean current specialist; and Dr. A. Forbes-McKay, surgeon, the two latter having been with Shackleton in 1907–9. Besides these, Stefánsson, who had left the ship with four others on a hunting trip before it was crushed, started on a side exploring expedition to Banks Land five months ago, and has not been heard from since.

The Deluge Preceded the Fall of Man.—According to a translation of a recently deciphered inscription on one of the Sumerian tablets, Prof. Langdon, of Jesus College, Oxford, says the deluge preceded the fall of man The tablet, which has been almost completely restored, contains six finely written columns of about 240 lines, most of which are intact. It begins by describing the land of primeval bliss, which it locates at Dilmun, an island in the Persian Gulf. "In this paradise dwelled mankind, whom Nintud, the creatress, with the help of Enlil had created. After the Deluge, this King is called Tagtug, the Divine. And this Tagtug lives in a garden, is himself a gardener, and the wise Enki reveals unto him wisdom. The Greek historians, too, preserve this legend in the story of Oannes, who rose from the Persian Gulf to teach men wisdom in primeval times. And so Tagtug, as in the Hebrew history of Noah, plants a garden, names the trees and plants, and is permitted to eat of all but the cereals too, an herb of healing *par excellence*. Of this plant Tagtug was not to eat, for thereby he would attain eternal life. Mankind until this time possessed extreme longevity, but not immortality. Tagtug, on his own initiative, takes and eats. He is cursed by Nintud and becomes a prey to disease and ordinary mortality. Thus in the original Sumerian story Noah, the survivor of the flood, is the one who eats from the tree of life. No woman is concerned in this disobedience which resulted in our loss of perfect health, peace and countless years."

Automobile

New York and Chicago Motor Show Dates Set.—As heretofore, the New York annual automobile and accessory show will be held in January, the date being the week of 2nd–9th. Grand Central Palace will be used. The Chicago show, which is the only other national affair, is to be held January 23rd–30th.

German Benzol Increasing.—That Germany is not placing as great reliance upon gasoline, or as it is styled abroad, petrol, as heretofore, in indicated by the fact that during the past few years the production of benzol has increased markedly. For instance, whereas the output during 1909 was but 29,470 tons, the figures for 1910, 1911 and 1912 are 42,767, 53,941 and 60,401 tons, respectively. Later figures are not available.

Throwing the Headlight in Either Direction.—Alden L. McMurtry, of Sound Beach, Conn., realizing that at times it is desirable to move an automobile rearwardly as well as to the front, has provided, in patent, No. 1,105,035, a lighting system for automobiles and other vehicles which may be reversed, which lighting system may be operated to throw a powerful light to the front or rear according to the direction of movement, and this without interfering with the ordinary rear lights of the vehicle.

Paris Bans Steel-Shod Tires.—In Paris, an order recently has gone into effect prohibiting the use of steel-shod tires within the Metropolitan area, after the opening of the new year. In the meantime, vehicles so shod must proceed at what is virtually a snail's pace. As a direct result, most of the vehicles designed for metal tires have been converted already and the remaining few evidently are being worked to destruction before being withdrawn. Only a few years ago there was a considerable boom in steel-shod commercial vehicles, and the change is all the more noteworthy.

Fire Extinguishers Upon Motorcars.—It is interesting to note, particularly in view of the widespread safety first movement, that a number of the insurance companies writing fire risks upon motorcars have taken a certain means to reduce the fire hazard by agreeing to a reduction in premiums, provided carbon tetrachloride extinguishers are carried on the cars. So far no manufacturer has evidenced any inclination to include a fire extinguisher in the standard equipment, though it would seem that this might be done with profit The reduction in the premium amounts to 15 per cent.

Skew Bevel Gears Increasing.—Although the worm gear, which has made such strides abroad, has not yet "caught on" to any great extent in America, the fact of its existence has stimulated the desire for something quieter than the ordinary bevel gear. As a result, several manufacturers have incorporated in their new products what is virtually a cross between the two. It is styled a skew bevel gear. It differs from the usual bevel gear in that the teeth are not straight and placed at right angles to the center, but are slightly curved. The result is that whatever clash there may be in a bevel gear is eliminated, the teeth rather sliding together as they do in a worm. It is further pointed out that the skew gear reduces the backlash to the minimum.

Reducing Wind Resistance.—One of the noticeable trends in the 1914 models that made their appearance last fall was the gradual increase in the use of so-called streamline bodies. For the coming year, this tendency will be even more marked It would seem that in thus reducing the wind resistance of their products American designers are giving evidence of having learned a valuable lesson from their foreign contemporaries. The streamline body long has been appreciated abroad, where the careful reduction of wind resistance to the minimum has been well worked out. The use of smooth-sided bodies, from which abrupt angles have been eliminated, no doubt is in a measure responsible for the noteworthy fuel economy that is a feature of so many foreign cars. Another feature of motorcar construction to which much attention might be paid is the more careful distribution of weight. A careful balancing of the load would minimize skidding proclivities, equalize to a greater extent the wear on tires and improve the riding qualities.

Positively Operated Poppet Valves.—The possibilities of the springless type of poppet valve were pretty thoroughly demonstrated in some of the recent foreign road races. In fact, they worked so well that there is every probability that they will come into fairly general use in the not far distant future. The positively operated valve differs from the usual type in that the cam not only opens the valve but closes it as well. In the generally accepted type of poppet valve, the valve itself is closed by a heavy spring. It is claimed for the springless valves that a higher rate of speed is possible; that greater power naturally results and that the factor of safety is increased. With the spring-controlled valve, the piston speed is limited by the inability of the spring to close the valve before the cam has come around and started to open it again. Heavy springs and light valves have partly solved the problem, which still remains where springs are used. With the positively operated valve it is no longer the valve which limits the speed of the motor.

Inventions

Rejuvenating Old Wells.—Walter O Snelling, of Pittsburgh, in a patent, No. 1,104,011, employs heat in treating old oil and gas wells for rejuvenating the same.

Substitution of Material in a Milking Machine.—Patent No. 1,103,974 has issued upon the invention of Knut Ivar Lindstrom, of Vibynas, Nykvarn, Sweden, for a milking machine in which the connecting tubes are made of a transparent elastic material, particularly celluloid, so the milk flowing in the tubes can be observed.

An Elihu Thomson Oil Engine.—In a patent, No. 1,105,047, Elihu Thomson, of Swampscott, Mass., for utilizing heavy oils in internal combustion engines, provides a vaporizer involving a tortuous passage in a body of resistant material, which is heated by passing an electric current through it for vaporizing purposes.

Uniting Glass in Bifocals.—Patents Nos 1,103,961 and 1,103,962 have issued to Benjamin N Hanna, of Pittsburgh, Pa., relating particularly to the manufacture of bifocal lenses and utilizing the principle of thermal expansion in uniting the two bodies of glass, patent No. 1,103,961 being for the method and the other patent being for the spectacle glass.

The San Francisco Branch of the Patent Office.—Commissioner Ewing announces that, in compliance with Congressional action, a branch office of the United States Patent Office has been opened at San Francisco for the purpose of issuing certificates of proprietorship, as provided in the act for such purpose relating to the Panama Pacific Exposition.

Artificial Day-light.—Herbert E. Ives, of Mount Airy, Pa., in a patent, No. 1,104,900, seeks to produce from artificial light the color effects of day-light, for use in dyeing and in surgical work where it is important to know the relative colors of tissues, by means of a goggle having color-filtering screens as specified more in detail in the patent.

Toys as Objects of Invention. The toy famine referred to as a probable result of the effects of war upon the European toy producing centers should stimulate American production of existing forms of toys, and also the origination and invention of distinctly new toy objects The enormous profits attributed to some very simple toys is sufficient to encourage inventive effort in such direction.

A Bottle Cleaning Process.—The following method is said to be a very good one for washing bottles which contained an oily substance, such being often very difficult to clean. It suffices to wash the bottle with very hot coffee grounds in order to remove such substances In connection with this, it is recommended to use a solution of bichromate of potash and sulphuric acid in equal proportions, taking care to avoid contact with the skin, for such liquid is very corrosive. Rinse several times in pure water. These two methods must, of course, be used separately.

Eye-glass Improvement.—Among eye-glasses of the nose clamping kind a popular style is that in which the levers have the nose clamping jaws at the inner side of the glasses and handle-like parts projecting outwardly so they can be pressed together by the forefinger and thumb to spread the nose clamping jaws A correspondent suggests the possibility of some practical connections leading to an operative device at the outer edges of the right lens to avoid the forwardly projecting handle portions and also avoid blurring the lenses by the fingers in operating the clamps.

An Electric Drier for the Sea-shore.—Those who sojourn at the sea-shore note the effects of the dampness on the wearing apparel, particularly in comparing the condition of garments when they return home with the condition when they reach the sea-shore. It has occurred to the writer that some form of electrical drier might be devised which could be folded and placed in a trunk, and utilized to dry out garments before packing them for the return home. The drier might also be utilized in connection with any little laundry work the ladies frequently desire to carry on in their rooms, as well as for drying out wet bathing suits.

A New Device for Protecting Crops from Hail has been installed by R. Marcillac, in the Department of Ardèche, France, and a model of it was recently exhibited at Lyons Exposition. It consists of a series of tall posts arranged in a circle around a central post. All the posts are tipped with clusters of lightning rods, grounded with metal tapes. The outer posts are connected with each other and with the central post by metal cables, bearing rows of upright metal points. The total number of these points or terminals is 12,000, and the whole network covers an area of over 9,500 square yards This elaborate device is supposed to protect the crops growing beneath it from the fall of hailstones, on the altogether fallacious assumption that a hailstorm is the result of the electrification of the atmosphere. The same idea has led to the erection all over France of tall lightning-rods, known as "electric Niagaras," which are intended to draw the electric charge from the clouds, and thereby prevent the formation of hailstones.

Volcanic Clouds

By Immanuel Friedländer

TWO kinds of steam cloud may sometimes be seen on one and the same volcano. One kind is whitish and dissolves readily into the air; the other more or less brown or black and heavily charged with ash. Fig. 1 shows four vents of Stromboli in action, with specimens of both types of cloud. The cauliflower forms of ascending ash-laden explosion clouds are well known. These occur in nearly all great volcanic eruptions, and also often persist for a long time during comparatively quiescent periods. Fig. 2 shows the cloud over Aso-San in 1908. This vent was in an approximately uniform state of activity during the period 1906-08.

Besides the above-mentioned cauliflower forms, smoke rings often occur, resembling those which tobacco-smokers are fond of making (Fig. 3). Probably on account of strong condensation, with resulting differences in refraction, luminous rings are sometimes seen in violent explosive eruptions; a phenomenon which has hitherto been observed only by Perret. Their appearance is presumably dependent upon the sun, the point of eruption and the observer being in approximately the same vertical plane.* In Fig. 4 the rings were drawn on the photograph by Perret (who took this picture, as well as Figs. 1 and 2), as they were not bright enough to impress their image on the photographic plate.

Dust clouds, due to little atmospheric vortices, very often occur on volcanoes, especially under strong insolation. These small dust-whirls have, strictly speaking, little to do with volcanic phenomena, and are only mentioned here because they are very frequent on dusty volcanic summits and are easily mistaken for fumaroles. Moreover, small or large landslips, giving rise to avalanches of stones or dust, often fling up whirling clouds of dust which are not easily distinguished from ash-laden explosion clouds. After the great outbreak of Vesuvius in 1906 such dust clouds were repeatedly mistaken for renewals of volcanic activity. In some cases, in fact, they caused a light fall of ashes in the vicinity of the volcano, and even as far away as Resina. Very similar to the clouds of ash due to true volcanic explosions are the clouds produced by explosions occurring when large volumes of snow are buried under freshly ejected hot volcanic material. These explosions are well-known and dreaded phenomena on the slopes of Etna. In many instances patches of snow, and in others cisterns of human construction, explode under the lava. Such explosions may also occur under a layer of hot lapilli or ashes, as was observed on Mont Pelé in 1012.—Extracted and translated from *Zeitschrift für Vulkanologie.*

* Are not these more probably diffraction rings, identical with the "glory" seen around the shadow of the observer in the specter of the Brocken?—EDITOR



Fig. 1.—Eruption of Stromboli, showing two types of steam cloud.

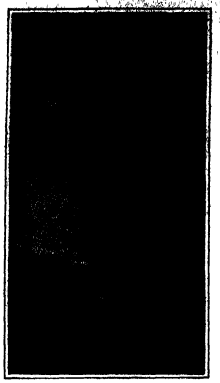


Fig. 2.—Cauliflower cloud. Eruption of Aso-San, 1908.

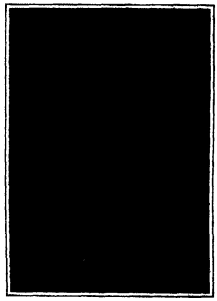


Fig. 3.—Smoke-ring. Eruption of Etna. The white spot near bottom is the sun.

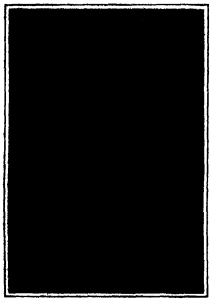


Fig. 4.—Luminous diffraction rings accompanying a volcanic cloud. Observed by Perret.

A Tunnel Under the Solent, to connect the Isle of Wight with the mainland, is under consideration.

The United States Battleship "Pennsylvania" and Class

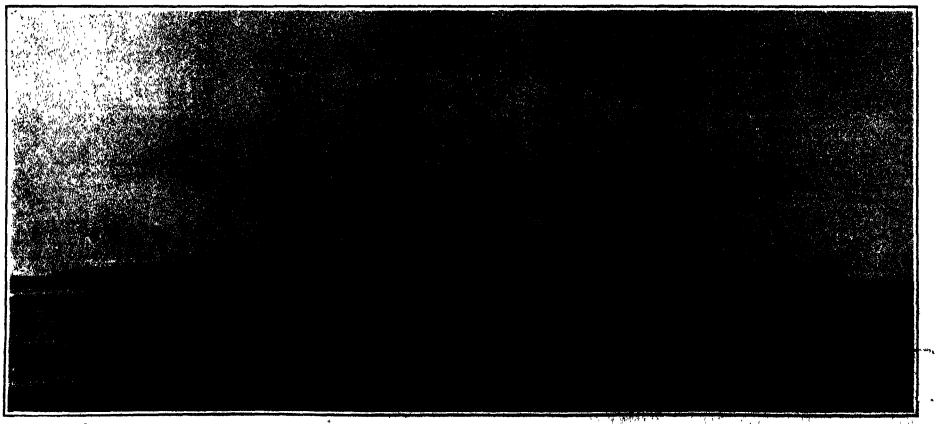
IN view of the terrific punishing power of the latest guns being mounted on the warships of foreign powers, it is the policy of our Navy Department to pay special attention to the protection of our battleships against loss or disablement by gunfire. This is very noticeable in the first of our ships to carry the three-gun turret—the "Oklahoma" and "Nevada." These ships, which are of 27,500 tons displacement and carry a main battery of ten 14-inch guns, are protected by a water-line belt of 13½ inches maximum thickness, which is 17½ feet wide. The ships are protected by 16 inches of armor on the conning tower, and the port plates of the three-gun turrets are no less than 18 inches in thickness.

The "Pennsylvania" class, of which two are now under construction, one at Newport News and the other at the Brooklyn yard, are enlarged "Oklahomas," of 4,000 tons greater displacement and mounting two additional 14-inch guns. The armor protection is heavier, and the protection against under-water attack has been amplified by the further extension of the subdivision and by the provision of improved anti-torpedo bulkheads, designed to localize the effects of the very heavy gun-cotton charges carried in the head of the latest torpedoes.

The accompanying illustration, which has been drawn from the finally approved official plans, shows the "Pennsylvania" to be a handsome ship, judged from the standpoint of modern dreadnought design. The most striking feature is that she is to carry a clipper bow, the customary ram bow giving place to the inward curve, which was such a familiar feature in the earlier transatlantic steamships. This transition was foreshadowed in our first dreadnoughts, the "Delaware" and "North Dakota," in which, with a view to giving greater buoyancy in a head sea, the deck-line was flared out and carried forward well out over the ram. The destructive power of the modern gun, and the certainty that, long before it could get within ramming distance, a ship would be sunk or completely disabled, has rendered logical the abolition of the ram altogether. This not only saves a large amount of weight and much costly construction, but it makes it possible to cut away considerable deadwood forward, and conduces to a quicker answering of the helm and better all-round maneuvering power.

The "Pennsylvania" has a long forecastle deck which is carried aft to the main lattice mast. Forward on this deck are two turrets, each containing three 14-inch guns, the guns of the after turret firing above the roof

(Concluded on page 254.)



United States battleship "Pennsylvania."

4 Tons, 32,000. Speed, 21 knots. Guns, twelve 14 inch, twenty-two 5-inch. Torpedo tubes, four 21-inch. Side Armor, 14 inches. Cost, $15,000,000.

The Automobile of the Sea

A Water Sled That Contains Many Innovations in Hull and Propulsion

A NEW type of vessel has been produced by a Nova Scotia inventor, Albert Hickman, which promises to revolutionize water craft, and which takes the same place on the water that an automobile does on land, with all its speed and comfort.

The craft may be said to be a direct reaction from the general development of hydroplanic boats which have been used only for racing purposes, and an effort to transform the hydroplane into a successful pleasure craft. In the language of the builders, the sea sled is supposed to "carry the number of people you would carry in your car, and through ordinarily rough water, at the same speed your car would make on land, free from pounding, free from flying water, and free from danger"; and Mr. Hickman has gone to the extent of claiming that it is not a boat which he is trying to introduce, but a series of principles which are entirely at variance with those heretofore accepted in connection with craft that were to travel at speed on the water.

The first axiom in this connection is that any type of motor speed boat becomes more or less a hydroplane, that is, tends to run on the surface of the water, rather than through it; and unfortunately ordinary hydroplanes have heretofore been unsatisfactory craft for pleasure, especially in rough water.

Hydroplanes were invariably driven by screw propellers, and all embody a number of defects which may be summed up as follows: The under-water shafting with the strut bearing, etc., creates considerable resistance, is very liable to damage and makes the draft considerable; and, moreover, such an arrangement cannot be driven through weeds.

As the engine position is necessarily well aft, a screw propeller installation in a hydroplane necessitates carrying the engine shaft forward and transmitting the entire power of the engine through a gear to the propeller shaft, which is then carried aft again under the boat, involving long shafting, excessive weights, and loss of power. The screw propeller is also subject to cavitation when run at high speeds, making it decidedly inefficient.

In the development of the sea sled, the object, as far as the propeller system was concerned, was to do away with these inherent defects, and Mr. Hickman discarded the under-water screw propeller and devised the surface propeller system, and he depends for the success of the surface propeller system on a relatively high inertia of the water at speed, which is responsible for so many of the peculiarities of the hydroplane. The shaft line in a sea sled, instead of being carried forward in the boat to a gear transmission and then aft to the propeller to give a sufficiently low shaft angle, is carried out directly through a shaft log across the lower edge of the transom of the boat. This means that when the craft is at speed only the lower blades of the propellers would be in the water, and the shaft and the boss of the propeller are altogether out of water, and the inertia of the water, as it passes out from under the stern of the craft, in conjunction with the position of the shafts in relation to the hull, absolutely regulates the dip of the propeller blades, either in rough or smooth water, so long as the stern of the craft remains in contact with the water at all. This regulation of the dip of the blades is responsible for the success of the surface propeller.

Now let us see how the surface propeller system applies in doing away with the difficulties of the screw propeller in hydroplanes.

Referring to the basic troubles of the ordinary under-water propeller cited above, we find the following advantages for the surface propeller system: There is no under-water shafting, strut bearings, etc., to cause increased resistance, or liable to injury.

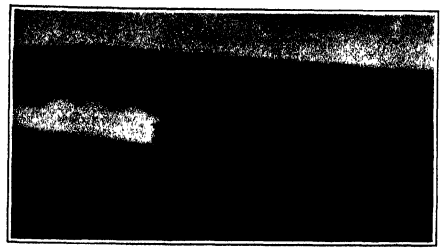
The surface propeller craft runs easily through heavy weed growths at high speeds, and there is no tendency to foul the propellers, and the draft of water is one half that of a screw propeller boat of similar size. A 25-foot screw propeller speed boat has, say 30 inches draft at speed. A 25-foot surface propeller boat has less than 15 inches at speed.

Instead of the shafting running in water in non-lubricated bearings, it runs in a strong bearing which is carried in a thwartship timber let into the hull of the boat, carrying a stuffing box which is thoroughly lubricated by a force feed oil pump. Another important point is that the surface propeller is free from any tendency to cavitation, for a reason not at first obvious. When a screw propeller is employed to drive a hydroplane, its area is reduced to the lowest possible limit consistent with planing the boat, so that the engine may be able to handle the propeller at the highest possible number of revolutions after planing has occurred. This means that the propeller is so nearly up to critical pressures that any encroachment of air from the surface, as in broken water, causes total cavitation. The surface propeller, however, may be said to be in a condition of normal cavitation. It depends absolutely on the inertia of the water acting against the face of the blades, and not on the inertia plus a certain water column, plus a certain air pressure. Its wetted area is normally considerably larger than that of the ordinary screw propeller, and the result is that no tendency to cavitation is indicated.

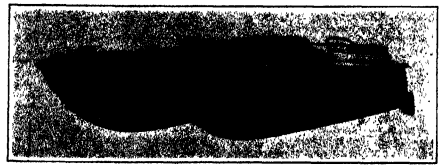
Where one engine is employed one propeller is driven direct by the engine and the other through a gear on the tail shaft line. Where two engines are employed the propellers are driven direct by the engines, through short, stout shafts.

It is to be noted, also, that when two engines are used independently, the throttling of either, in conjunction with the rudder action, furnishes a much more rapid system of steering and control than would be possible under twin screw propellers.

Speaking generally, hydroplane hulls have been of flat, convex, V, or hollow-sided V section, with the keel in all cases below the chine, or angle of the bilge. Even where certain hydroplanes were of hollow section aft, with the chines below the keel, the sections merged into V or convex sections forward. Whatever the modification of bottom may have been the boats were subject to more or less heavy pounding when running at speed in broken water, and even fairly sharp V sections did not obviate this defect. Other points of criticism in regard to the usual type of speed boat are as follows: The ordinary hydroplane works satisfactorily at weights not in excess of 45 pounds to the horse-power, this again being the result of the type of bottom section. Moreover, the accepted type of hydroplane still retains one of the characteristic features of the displacement boat, the vertical stem; and consequently not only incurving topsides forward, but incurving waterlines as well. This meant that if the wedge of the bow was forcibly submerged at speed, as when the stern is lifted on a following sea, the boat must tend to slide, or to plane on whichever side the greatest mass of water lay. That is, if the boat were inclined to starboard, she must plane on the surfaces of the starboard bow which were incurving toward the port side, or, more briefly, if she listed to starboard, she must plane to port, her momentum tending to turn her over. This action, known as tripping, was one of the



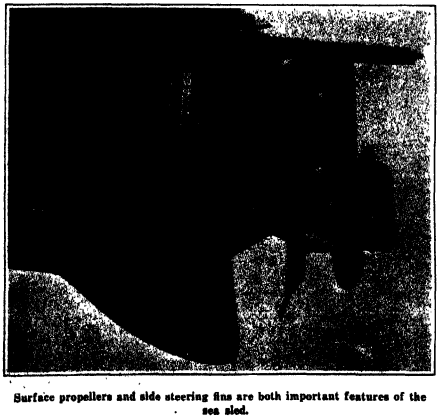
Sea sled built for the United States Navy, running at a speed of 36.45 miles per hour.



View of sea sled, showing inverted V form of hull.



Power and control installation.



Surface propellers and side steering fins are both important features of the sea sled.

main dangers and defects of the hydroplane in practical service, and meant not only danger of capsizing but loss of control in rough water.

Another objection was that the incurving topsides forward resulted in the bluff of the bow raising water which would be thrown inboard, especially at moderate speeds

The object of the new hull was to do away with these defects, and in the attempt virtually every feature of the hydroplane boat as generally understood was reversed. Thus the new craft are of inverted V section, with the keel higher than the chines, or angles of the bilge, at all points, instead of the bottoms being of convex or V sections, the deepest inverted V being near the bow with the depth decreasing toward the stern. By this construction, instead of spray being thrown out it is gathered in under the bottom, and the craft rides on a cushion of mixed water and air, each wave acting as an air compressor, forcing more air under the bottom This feature has done away with pounding more effectively than anything that has been attempted. This inverted V construction has also resulted in a much greater planing weight than was practical with the older forms of hydroplane, these boats running well with weights in excess of 70 pounds to the horse-power.

The vertical stem is replaced by a horizontal stem, the topsides forward, instead of being incurving, are left parallel, the craft being wider at the bow than at the stern, and the water-lines forward are outcurving instead of incurving This means that if the craft is turned to starboard, instead of tending to plane to port, she planes to starboard, and so rights herself. It means also that the control is absolute when running in any direction in relation to the sea; so yawing, tripping, and bad control are eliminated. Moreover, the topsides, being parallel, have no tendency to raise water above the deck line, and, as all spray is carried under the craft, instead of out at the sides to be blown inboard, the two chief elements of wetness are done away with.

In this novel craft not even the steering system is left to recall other motor craft. Steering fins, also the invention of Mr. Hickman, are used These are hinged to the sides of the craft and are operated by a push rod traveling athwartship on the transom, operated by a rack and pinion The pinion is on the end of the shaft which enters the hull through a stuffing box and is connected by bevel gears with steering wheel column The fin hinges are not vertical, but are at an angle of about 30 degrees, varying with the power installed, and in action the fins undercut and so pull down the inward side of the craft on the turn, bringing the outcurving water lines of that side into action This results in greater rapidity of steering and in freedom from skidding. In fact, small craft of the type may be steered accurately by inclining without the use of the fins. In the twin engine craft varying speeds of the propellers adds a still further element to the rapidity of control

The sea sled is of a truss type The engines are right-hand and left hand, having four cylinders, 4½-inch bore by 6-inch stroke, rated at 75 horse-power, but delivering 80 horse-power at 1,500 revolutions. The engines are placed between bulkheads amidships and are entirely inclosed Fully equipped with four or five passengers aboard, a weight of approximately two tons, a speed of 35 miles has been attained, and with one passenger an accurate speed test of one of these craft recently showed a speed of 34 knots, or 39 15 statute miles per hour

The crafts have already been put to tests which would be considered impossible for the older types of speed boat A 20 foot sea sled went around Cape Cod from Boston to New York and a 26 foot sled ran from Boston to Bar Harbor, much of the time in a stiff easterly breeze, at an average speed of 28 miles for the trip.

Summing up the facts given, it is apparent that the sea sled is a complete reversal of formerly accepted speed boat principles, and the combination of features in the new crafts appears to be entirely novel, for which applications for patents have been made covering the points involved In the meantime the sea sled has unquestionably proved itself to be a fine all-round water vehicle for speed purposes.

When the clutch is thrown in, the easily revolving surface propellers hardly slow the engine a revolution, and there is no tendency to stall on low throttle. With the throttles opened wide a considerable mound of water is thrown out aft, and the craft begins to lift and ride on the surface of the water at a speed of from 15 to 17 miles an hour. The sensation when riding in one of the crafts is delightful and differs from that of the ordinary speed boat, as the craft is evidently riding on an air cushion which practically eliminates all shocks when running over choppy water. At higher speeds no tendency to instability is felt, the craft automatically maintaining herself on a practically even keel even when running in the trough of a heavy chop. Even in the roughest water the craft is much dryer than other types, and to take solid water over the deck seems to be an impossibility.

Important Communications from the Commissioner of Patents

THE laws of the United States expressly state that patents shall be granted only to first inventors. Hence it is necessary to file with the drawings and patent specifications in which their invention is disclosed, a petition and an oath signed by the inventor himself with due formalities. But what shall be done when, as at present, a foreign inventor finds it difficult, if not impossible, to comply with the statutory requirements? What shall be done, moreover, when the period fixed by the International Convention for the filing of patent applications is so rapidly nearing its close that it is hopeless to secure the signature of an inventor whose instructions were sent to his attorney shortly before war was declared?

The situation arose in two applications which Messrs. Munn & Co. had to file on behalf of foreign inventors whose rights were thus jeopardized through no fault of their own. It was decided to file an application with a petition signed by Messrs. Munn & Co. as attorneys and an oath sworn to by a member of the firm. Our inventor readers in foreign countries will learn with satisfaction that the Commissioner of Patents, in view of the extraordinary circumstances, accepted the papers thus filed.

In order to give the widest possible publicity to the Patent Office's policy, and in order to relieve any apprehension that may exist among foreigners, the Commissioner of Patents has requested us to publish his letter accepting the two applications from Messrs. Munn & Co. The letter follows:

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., September 10, 1914.

MESSRS. MUNN & CO.,
Washington, D. C.

Gentlemen:—I am accepting two applications filed by you as attorneys to day, wherein the inventor's name to the petition and specification is signed by you as attorneys and the oath is made by a member of your firm The time for filing these applications expires under the Convention to morrow There fore, in filing these applications in the form in which you have presented them, you are doing all that you can to save your client's rights, and in permitting them to be filed and giving them a serial number and date of filing of to day I am doing all I can with the same end in view. If this should not prove to be effective, the loss must be attributed to the troubled conditions of Europe and not laid at your door or that of the Office.

It will be necessary before patents are granted that applications be filed executed by the inventor himself, as provided in Section 4888. Whether the applications to be filed can be tided to the applications which you are filing to day under the provisions of Section 4887 is, of course, a matter which only a court of last resort can determine. *Ex parte* Tropeano (90 O. G., 749) to the contrary notwithstanding. I think it a possible construction of Section 4887 that its requirements may be satisfied by the filing of applications executed by an attorney

I hope, however, in case there are a number of applications executed by attorneys, that Congress may be induced to validate patents granted or to be granted upon proceedings indicated above. Respectfully,

(Signed) THOMAS EWING, Commissioner.

Indorsements of Patent Attorneys by Congressmen

IT has been the practice in a certain class among patent attorneys to state in their advertisements that they are heartily endorsed by well-known members of Congress. There can be no question that both senators and representatives have given such letters to attorneys, some of whom indulge in practices that can hardly be sanctioned under that unwritten code which governs the foremost members of the patent profession. There can also be no question that the congressmen who have been asked for these indorsements did not realise at the time how their letters would be utilized. The practice has grown to such proportions that the Commissioner of Patents has called the attention of congressmen to the effect of their too willing compliance with requests for endorsement in leading many unsuspecting inventors to place their business with attorneys who, to say the least, are no more qualified than others on the roster of patent attorneys to handle patent matters expeditiously and efficiently. Furthermore, the impression is created that the congressman uses his influence to secure quick and favorable action from the Patent Office.

At the request of the Commissioner of Patents we publish the following correspondence which has passed between him and a member of the Senate. We have refrained for reasons that are obvious to our readers from publishing the names of the attorneys named in the correspondence that follows:

DEPARTMENT OF THE INTERIOR,
UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., July 27, 1914.

HON. MILES POINDEXTER,
United States Senate,
Washington, D. C.

Dear Senator Poindexter: An advertisement appeared in the Seattle *Sunday Times* of May 31st, 1914 (since discontinued) by and Son, reading as follows: "Patents, Trade Marks, book Free Strong letter from Senator Poindexter, and Son, Patent Lawyers, est. 1877—Street, N.W., Washington, D. C." On June 4th, Mr , a lawyer making a specialty of patents with an office in the New York Building, Seattle, Washington, wrote to me that he had always regarded it improper to express their belief that if their clients or and Son in the matter of prosecuting applications, they and Son can have Senator Poindexter personally influence the Patent Office and thereby get quick and favorable action.

In response to this letter I wrote to Mr, saying that if he would give me the names of the two inventors I would call your attention to it. Not receiving any reply, I wrote to him again on July 17th, inclosing a copy of my former letter. I am in receipt from him of a letter to me saying that the names of the inventors are Wallace Wilson, 1716 Boylston Avenue, Seattle, Washington, and Frank Warren, 1615 Fifteenth Avenue, Seattle, Washington.

I am of course fully aware that you had no intention of giving any such impression as these inventors drew from the statement of and Son, and there is nothing to show that and Son had any such intention. but this correspondence is a specific showing of the fact that inventors draw a conclusion from letters of Senators and Representatives, which makes it, in my opinion and in the opinion of the Office, highly undesirable that Senators and Representatives give such letters to solicitors of patents.

I submit this for your friendly consideration and will send you copies of the entire correspondence if you so desire.

Sincerely yours,
(Signed) THOMAS EWING, Commissioner.

UNITED STATES SENATE,
COMMITTEE ON EXPENDITURES IN THE WAR DEPARTMENT.
PERSONAL. AUGUST 18, 1914.

HON. THOMAS EWING,
U. S. Commissioner of Patents,
Washington, D. C.

My dear Mr. Ewing: Your letter of the 27th ultimo which reached my office while I was away is at hand, and I am very much obliged to you for calling my attention to the circumstances stated therein. It is extremely exasperating, and I agree with you entirely that it illustrates the advisability of writing no letters of commendation to solicitors of patents, and I believe the same thing applies to any other person engaged in business or having anything to sell. I receive a great many requests for some expression of opinion in regard to books, and the letter I gave Mr was six lines, acknowledging the receipt of a compilation of patent laws which he had prepared. I have known him for some time and found it difficult to refuse his request for a brief expression of opinion

I will be very much obliged if you will send me copies of the entire correspondence you refer to, as I want to take the matter up with the inventors who are alleged to have made the statements mentioned

Thanking you again for calling the matter to my attention, I remain, with very kind regards,

Very truly yours,
(Signed) MILES POINDEXTER.

UNITED STATES SENATE,
COMMITTEE ON EXPENDITURES IN THE WAR DEPARTMENT.
HON. THOMAS EWING, AUGUST 21, 1914.
Commissioner of Patents,
Washington, D. C.

Dear Mr. Ewing: I have yours of 20th instant and if it will be of any service to the administration of your Office to publish the correspondence referred to, I have no objection.

Very truly yours,
MILES POINDEXTER.

The Current Supplement

IN the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2021, there is a story of the Cyclopean Mystery at Abydos, telling of some wonderful ruins recently discovered in Egypt that date back to the earliest periods known to man, and the illustrations give an idea of the huge masonry of the structure which includes the long sought tomb of Osiris and Strabo's well. One of the great engineering works that are being carried out by the different railway companies for the improvement of traffic is described in the article on the Magnolia Cut-off, on the Baltimore & Ohio Railroad, and the numerous illustrations tell a story of their own on how a railroad is built. There is another instalment on the great address by Prof. Bateson on Heredity in this issue, as well as an interesting paper on plant autographs, showing how plants are compelled to make a written record of their life story. A paper by Orville Wright, who is probably the best known expert in the world on the subject, tells of the intricate questions connected with the stability of aeroplanes, and his explanation, given in considerable detail, without any figures or mathematics, is one of the clearest and most easily understood discussions that has yet appeared. Problems involved in the cracking of oils are treated in a carefully written article that will interest automobile engineers.

The Work a Watch Does.—Out of sight, out of mind, is particularly true in regard to the mechanism of a watch, and even those interested in mechanical matters seldom consider the amount of work performed by this useful little piece of machinery. Take the balance wheel, for example. In the average watch this vibrates 300 times a minute, 18,000 times each hour, 432,000 times a day and 157,788,000 times a year. As each vibration covers about one and a half revolutions, the shaft on which the balance wheel is mounted makes 236,682,000 revolutions in its bearings each year. Compare this with a modern locomotive with 7-foot drivers, which would have to run 985,824 miles to make an equal number of revolutions; and, running at the rate of a mile a minute, without stopping, it would take 683 days, or nearly two years for the axle of the drive wheel of the locomotive to make as many revolutions as the balance wheel shaft of the watch does in one year, and it would cover a distance of over 39 times around the world.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Origin of Life

To the Editor of the SCIENTIFIC AMERICAN:

Your article in issue of August 1st on "Another View of the Origin of Life," referring to the action of chlorophyl in transforming the energy of sunlight into chemical energy, closes with the words, "Thus life has originated, and probably still originates, by the law of molecular complexity."

Dr. William Hanna Thomson in his "What is Physical Life? Its Origin and Nature," makes short work of all these materialistic, physico-chemical theories of the origin of life, supporting his argument with quotations from leading authorities.

I believe there is not one single biologist of any note who would entertain for a moment the physico-chemical theory. In fact, the laws which govern physics and chemistry are totally and essentially different from those of life.

May I refer those interested in this subject to Bergson's "Creative Evolution," where they will find much of deep interest? He shows that the human intellect has arisen, or evolved, from the animal world especially to deal with matter, fabricating it into instruments for its use; the consequence is the brain "thinks matter," and is led to regard the world as a machine.

This is the reason why so many superficial thinkers incline to materialism, especially physicists. Intellect and instinct have both evolved from consciousness, but taken different paths—the former to deal with material surroundings, the latter with life.

"The intellect is characterized by a natural inability to comprehend life."

But "an intelligent being bears within himself the means to transcend his own nature."

Bergson also gives many examples showing that the mechanical theory of the universe is quite untenable; and Sir George Darwin in his presidential address to the British Association in 1905 said that the mystery of life is as impenetrable as ever. A. K. VENNING.

Los Angeles, Cal.

The Power Required to Stop an Automobile

To the Editor of the SCIENTIFIC AMERICAN:

In answer to X. Y. Z. concerning the power necessary to stop an automobile of given weight and in a given distance (July 4th issue), I submit the inclosed solution, which I believe to be correct. The answer, however, strictly speaking, is in force or work units, rather than in power, as the time required to stop the machine was not given.

SOLUTION.

Weight = 3,500 pounds.
Initial velocity = 20 miles per hour.
Final velocity = 0 mile per hour.
Distance = 30 feet.
Using following notation:

t = time,	av = average velocity,
s = distance,	v = final velocity,
a = acceleration,	u = initial velocity,
F = force in pounds,	ch = change in velocity,
W = weight in pounds,	n = constant = 32*,

20 mi./hr. = 105,600 ft./hr.

$$av = \frac{u + v}{2}$$

$$av = \frac{105{,}600 + 0}{2} = 52{,}800 \text{ ft./hr.}$$

$$t = \frac{s}{av}$$

$$t = \frac{30}{52{,}800} = .000568 \text{ hour} = 2.05 \text{ seconds}$$

$$ch = u - v,$$

$$ch = 105{,}600 - 0 = 105{,}600,$$

105,600 ft./hr. = 29.33 ft./sec.

$$a = \frac{ch}{t}$$

$$a = \frac{29.33}{2.05} = 14.309 \text{ ft./sec.}^2$$

$$F = \frac{W}{g} \times a$$

$$F = \frac{3{,}500}{32} \times 14.31$$

F = 1,565.69 pounds force required to stop automobile.

The pound is used in F as a force unit and in W as a weight unit; thus by using the constant g in the equation $F = \frac{W}{g} \times a$, W is changed to units equivalent to those of F.

To change answer to work:

$F \times S$ = work.

1,565.69 × 30 = 46,952.7 ft. lbs., work done

Freeport, L. I. EDWARD T. COLLINS.

* The value of g is 32 only when the pound is used as a force unit.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the automobile problem that appeared in the July 4th, 1914, issue of the SCIENTIFIC AMERICAN, may I submit the following analysis, which to me seems to be by far the simplest and clearest of any of the half dozen I have worked through?

First: Since the results are not affected by the character of the retardation, we will assume uniform retardation.

Then, if F = force,
M = mass,
W = weight,
A = acceleration,
G = acceleration due to gravity,

$$F = Ma = \left(\frac{W}{g}\right) a \qquad (1)$$

A fundamental mechanical expression, also from the familiar expression:

$$V^2 = 2AS \qquad (2)$$

in which V = velocity at any instant,
A = acceleration,
S = space passed over.

We get

$$a = \frac{v^2}{2s} \qquad (3)$$

Substituting 3 in 1, we get:

$$F = \left(\frac{W}{g}\right)\frac{v^2}{2s} \qquad (4)$$

In the problem proposed:
W = 3,500 lb.,
G = 32.16 ft./sec./sec. (usual value),
S = 30 ft.,

$$V = \left(\frac{88}{3}\right) \text{ft./sec.}$$

Arrived at from the easily remembered fact that

60 mi./hr. = 88 ft./sec

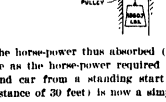
Hence 20 mi./hr. = $88\left(\frac{20}{60}\right)$ mi./hr.

Substituting these values, 4 becomes

$$F = \left(\frac{3500}{32.16}\right)\frac{\left(\frac{88}{3}\right)^2}{2(30)} =$$

$$\left(\frac{3500}{32.16}\right)\frac{\frac{22}{88}\left(\frac{11}{88}\right)}{9(2)30} = \frac{84700}{54.27} = 1560.7 \text{ pounds.}$$

Hence, if an automobile weighing 3,500 pounds were traveling at a uniform rate of 20 miles per hour and a backward pull of 1,560.7 pounds were being constantly and uniformly exerted on it, the car would come to rest in just 30 feet after power had been shut off (e. g., the clutch disengaged).



To find the horse-power thus absorbed (which would be the same as the horse-power required to accelerate a 3,500-pound car from a standing start to 20 miles within a distance of 30 feet) is now a simple matter.

$$\text{H. P.} = \frac{\text{ft. lb./sec.}}{550} \qquad (5)$$

Hence we must calculate the time required to bring the car to a stop under the conditions of the problem.

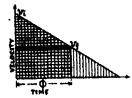
This is easiest shown graphically: Since in uniform motion

$$S = VT \qquad (6)$$

in uniformly accelerated motion

$$S = \frac{(v_i + v_f)}{2} t \qquad (7)$$

in which S = space passed over,
v_i = initial velocity (ft./sec.),
v_f = final velocity (ft./sec.),
t = time (seconds).



Seven is clearly so when it is considered that, referring to 6 and the diagram, obviously space is the product of (velocity) (time during which that velocity exists) which, in the diagram, means that space passed over = shaded area.

Thus, if ϕ units of time elapse, the area involved is expressed by 7.

When $v_i = 0$ (as in our case) 7 becomes

$$S = \left(\frac{v_f + 0}{2}\right) t = \frac{v_f t}{2} \qquad (8)$$

which may be expressed

$$t = \frac{2S}{v_f} \qquad (9)$$

which in our case is

$$t = \frac{2S}{v_f} = \frac{2(30)}{\left(\frac{88}{3}\right)} = 2\left(\frac{15}{30}\right)\left(\frac{3}{88}\right)\left(\frac{3}{22}\right) = \frac{45}{22} = 2\tfrac{1}{11} \text{ sec.}$$

Substituting in 5,

ft. = 30
lbs. = 1560
sec. = $t = \left(\frac{45}{22}\right)$

$$\text{H.P.} = \frac{\text{ft. lbs./sec}}{550} = \frac{30(1560)}{550\left[\frac{45}{22}\right]} = \frac{624}{15} = 41.6 \text{ H. P.}$$

Q. E. F.

Pilot Knob, N. Y. E. P. CULVER.

Technical Literature by Untechnical Men

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of July 11th, one Mr. Rindsfoos takes issue with a writer in a "high-class conservative monthly," who had had the temerity to write an article called "Skyscraper" without being able to append C.E. to his name.

I would suggest that Mr. Rindsfoos absorb that story of Tennyson and Adam Babbage.

The former wrote a poem called "The Vision of Sin," with lines which ran—

"Every moment dies a man,
Every moment one is born."

Babbage wrote to the poet:

"In your otherwise beautiful poem there is a verse which reads:

"'Every moment dies a man,
Every moment one is born.'

"It must be manifest that were this true, the population of the world would be at a standstill. In truth, the rate of birth is slightly in excess of that of death.

"I would suggest that in the next issue of your poem you have it read:

"'Every moment dies a man,
Every moment 1-1/16 is born.'

"Strictly speaking, that is not correct. The actual figure is a decimal so long I cannot get it in the line, but I believe 1/16 will be sufficiently accurate for poetry. I am, etc."

Mr. Rindsfoos may be a good engineer, but he ought not to measure literature with a micrometer.

Chicago, Ill. HOWARD V. O'BRIEN.

Who Ever Spent $5,000 for a Butterfly?

To the Editor of the SCIENTIFIC AMERICAN:

In an article on "Making Money Out of Butterflies," that appeared in the SCIENTIFIC AMERICAN for June 20th, Mr. Moulton says that some butterfly farmers of Europe have reared specimens selling for $5,000. Will not Mr. Moulton kindly tell your readers who these dealers are, and, above all, what the specimens are that are worth $5,000? It is barely possible that, like the statement "many mosquitoes weigh a pound," Mr. Moulton was treating of the sale of butterflies in the aggregate, but it sounds as if he meant—and he probably did mean—$5,000 each.

During my forty years' experience in both buying and selling natural history material, I have never even heard of a butterfly having sold for such an enormous price, nor, in fact, anything like that sum, and the statement is likely to arouse in some of your readers expectations destined never to be realized.

Many years ago, when at the United States National Museum, the correspondence clerk was kept busy contradicting the statement that a certain butterfly had recently been purchased for the sum of $20,000. Quite recently a statement, equally false, went the rounds of the papers, stating that Sir Walter Rothschild had paid $1,000 for a flea.

As a matter of fact, there is hardly a natural history specimen of any kind, save precious stones, that cannot be purchased for $5,000, and usually a great deal less. F. A. LUCAS,

Director of the American Museum of Natural History, New York city.



Copyright by Underwood & Underwood

The bombs which caused the damage here shown were intended for the wireless station, but fell wide of their mark. Although roofs were blown off and whole houses destroyed, no one was killed in this second attempt to bombard Antwerp from the air.

The Effect of the Zeppelin Bombardment of Antwerp

Remarkably Destructive Result of Shrapnel Bombs Dropped from the Sky

WHEN one views the photographs on these pages, photographs which show structures of Antwerp all but demolished by bombs hurled from Zeppelin dirigible airships, it seems incredible that thousands in the densely populated city were not killed outright. The bombs were filled with bullets and therefore resembled shrapnel shell, which is considered the best type of artillery ammunition for general use. Artillery shrapnel shells contain only a small bursting charge, for the velocity of the shells acquired by their propulsion from a field gun (about 2,000 feet per second at the muzzle) is sufficient to impart enough destructive energy to the bullets themselves, and to propel them after the shell has burst. Since the Zeppelin dropped its shrapnel bombs from a height that could not have been less than 3,000 nor more than 5,000 feet, it is not unlikely that more than a bursting charge was used. Our pictures certainly testify to a scattering effect which transcends anything that may be expected from ordinary shrapnel.

Terrible as the destruction was to property, the loss in human life was comparatively small. On the first attempt eight bombs were thrown down and twelve people killed. On the second attempt no one was killed, but several people were injured. In a densely populated city this can hardly be called slaughter

No technical accounts have reached this side of the Zeppelins' exploits, but according to William G. Shepherd, a United Press staff correspondent who writes in the New York *Sun*, an attempt was made to fight off the Zeppelin which sailed over Antwerp on September 2nd. He assures us that 30,000 soldiers were in the streets of Antwerp at the time and that all of them were shooting with their rifles directly at the Zeppelins which menaced their city. Whether this rifle fire drove off the Zeppelin or whether it had exhausted its supply of explosives does not appear, but the ship slowly drew away. It seems that the wireless telegraph station was the object of this second attack, although two of the eight bombs which were dropped fell within thirty yards of the Red Cross hospitals On this second attempt, two children, three women, and five men were injured, though not seriously, chiefly because all the terrified families of the city had taken refuge in cellars; the week before, the same Zeppelin had killed twelve people.

The British Dreadnought "Iron Duke"

THE spirited drawing on the cover of the present issue represents the "Iron Duke," flagship of Sir John Jellicoe, the commander-in-chief of the British fleet in the North Sea. The ship is shown stripped for action, with stanchions, rails, boats, etc., and everything that would interfere with the fire of the ship's batteries removed.

In this condition practically the whole of the ship's complement are behind armor and out of sight. Only upon the signal bridge and on the fire-control platform upon the mast are there any officers and men in the open.

If the engagement is taking place at the normal fighting range of, say, 9,000 to 10,000 yards, only the main battery of ten 13.5-inch guns mounted in the five turrets will be manned; the gun crews of the torpedo defense batteries, which are protected by armor too light to keep out the 11- or 12-inch shells of the German ships, will be below, behind the shelter of the heavy 10- and 12-inch belt and side armor. But each gun crew will be within easy reach of its own 6-inch gun, should the ship be threatened with attack by the enemy's destroyers. Such an attack would be unlikely except in the later phases of a line-of-battle engagement, when the battleships on one or both sides have been so badly punished that the main batteries are more or less silenced and the speed and maneuvering power of the ships has been impaired. It would be in this phase of the fight, probably, that the destroyer flotillas would attack, and then the defense of the ship would fall to the battery of 6-inch rapid-fire guns—or such of them as had not been disabled by the attack at long range with the main batteries of 11- and 12-inch guns.

The "Iron Duke" and her sister ships, "Marlborough," "Benbow," and "Emperor of India," are the last of the British ships to mount the 13.5-inch guns. The next following ten ships, viz., five of the "Queen Elizabeth" class and five of this year's programme, will each carry eight of the new 15-inch guns, which, as compared with the 13.5-inch gun of the "Iron Duke" class, show an increase of 30 per cent in energy and of 50 per cent in the destructive effects produced within the ship whose armor may be penetrated.

The "Iron Duke," as will be seen from the accompanying line engraving, mounts ten 13.5-inch guns in five turrets, all of which are mounted on the center-line of the ship. Two turrets are carried on the forecastle deck, one amidships on the main deck, and two aft on the quarter deck. These guns are protected by 12 inches of armor on the turrets and barbettes.

The torpedo defense battery of twelve 6-inch guns is mounted on the main and gun decks. Ten of these are carried in a battery forward of the mast, which is protected by 8 inches of armor, and eight of them can be trained dead ahead and two dead astern. The other two 12's are mounted aft on the gun deck.

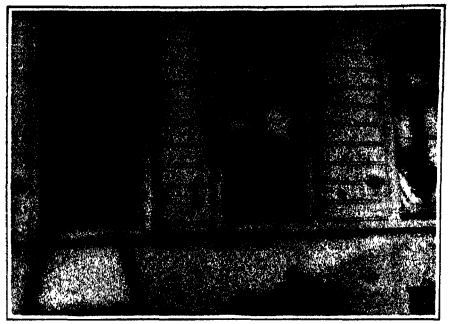
The concentration of fire is four 13.5-inch and eight 6-inch ahead, four 13.5-inch and four 6-inch astern, and ten 13.5-inch and six 6-inch on each beam. The "Iron Duke" also has four torpedo tubes for launching the 21-inch torpedo.

The armor protection of the hull is very complete, consisting of a main water-line belt 12 inches amidships and 6 inches at the ends, which extends 6 feet below the water-line and 10 feet above it, to the level of the gun deck. Above this, extending between No. 1 and



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Havoc caused to houses just outside the city by the second bomb-throwing raid on Antwerp.



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Windows broken in a residence in the Rue de la Justice. Note the holes made by shrapnel bullets.

No. 5 turrets, is an upper belt, 10 inches thick, which reaches to the main deck.

The ship is further protected by several steel decks, and, as a safeguard against aerial bombs, special steel armor is provided above the magazines. Several 3-inch, high-angle guns are carried as defense against aerial attack.

The "Iron Duke" is 580 feet long, 90 feet broad, and its normal draft is 28 feet, at which draft her displacement is 25,000 tons. The ship is driven by Parsons turbines, and with a shaft horse-power of 31,000, a speed of 22 knots is secured. The normal supply of coal is 1,000 tons and the maximum bunker capacity is 2,700 tons. Also 1,000 tons of oil are carried in the double bottom.

The flotation of the ship is assured, even in the case of severe mine or torpedo damage, by twenty-one transverse bulkheads, and by four longitudinal bulkheads, evenly spaced, which extend throughout the full length of the ship. This is supplemented by several watertight steel decks and flats, and by special, longitudinal, armored bulkheads to limit the explosive effects of the torpedo.

Aluminium Vessels

NOW that aluminium utensils are coming into use, it will be interesting to note the following experiments made by Prof. John Glaister of the Glasgow University, his object being to find whether various ailments were likely to attack the metal. He finds that the only substances that attack the surface are oranges, lemons, Brussels sprouts, and tomatoes, but even in this case the quantity of aluminium dissolved is insignificant and quite inoffensive. It is already known that aluminium is not affected by air at any temperature and it does not blacken on contact with hydrogen sulphide as silver does. As the metal is easily cleaned, it appears that such utensils have all the advantages, and all kinds of foods can be prepared in them without danger. Another advantage that they share with copper vessels is that, being of thin metal, they heat up very quickly. For electric or flame heaters, this means quite an economy of heat, as less heat is now lost in warming up the material of the vessel. This refers specially to rapid heating, such as boiling of water and the like.



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A view of the houses just outside the city of Antwerp which were wrecked in the second bomb-throwing raid of the German Zeppelin.

The Heavens in October

Ninth Satellite of Jupiter Discovered; Visibility of Delavan's Comet

By Henry Norris Russell, Ph.D.

AN announcement of much interest comes in a recent telegram from Prof. Tucker, who is at present acting director of the Lick Observatory, Prof. Campbell being detained abroad after observing the total solar eclipse of last August. On July 21st, Mr. Nicholson, at that observatory, photographed a faint object in the vicinity of Jupiter, near the eighth satellite, but still fainter. Further observations have been secured, and the telegram states that the calculation of the orbit of the newly discovered body proves it to be a satellite of the great planet—the ninth to be discovered. No further details are at hand at the moment of writing. It appears, however, that the new satellite must be remote from the planet, probably several millions of miles at the least, with a correspondingly long period. It will be very interesting to see whether it is moving around Jupiter in the same direction as the motion of the planets around the Sun (like the sixth and seventh satellites), or in the opposite direction, like the eighth.

This tiny body, however, is so faint that it must be near the limit of visibility, if not beyond it, in the greatest telescopes, and it can only be observed photographically. The amateur observer can find more to interest him in Delavan's comet, which is now a conspicuous object, and will be so throughout October. At the present time it is so far north that it just grazes the northern horizon at about 10:30 P. M., and is visible both in the evening, low down and a little west of north, and in the morning, higher up and in the northeast. It appears to the eye fully as bright as a third magnitude star, and has a tail several degrees in length. Prof. Barnard, at the recent meeting of the American Astronomical Society, called attention to the fact that, in the case of this comet, as much could be seen of the tail with the naked eye as could be photographed. For most comets the tail is far brighter photographically than visually. In the present case there must be a much smaller proportion of violet and ultra-violet light in the radiation of the tail than ordinarily.

On October 1st the comet will be in approximately 12 hours 30 minutes right ascension and 44 degrees north declination, and can be found by drawing a line from α to γ Ursæ Majoris (diagonally across the bowl of the Great Dipper) and carrying it southward for about its own length. On the 5th it passes about 2 degrees north of the bright star α Canum Venaticorum. It continues to move east and south into Boötes, and on the 27th it will be about 6 degrees north of Arcturus. It is so bright now that a mere glance along this line will reveal it, if only the sky is clear and the moon out of sight. All through the month the comet is in almost the same right ascension as the Sun, so that it is visible in the northwest just after dark and the northeast before dawn. It is so far from the Sun in the heavens—41 degrees north of him on the 1st and 38 degrees on the 31st—that it will be well above the horizon after twilight has faded and before it begins.

Though it appears fairly near the Sun in the heavens, it is actually far behind it. Its nearest approach to us, about October 5th, leaves it fully 345 million miles distant, and by the end of October it is 360 million miles from us. Its tail, too (which is directed away from the Sun), points away from us, so that we see it very much foreshortened, which accounts for its apparent shortness and relatively wide angle of divergence.

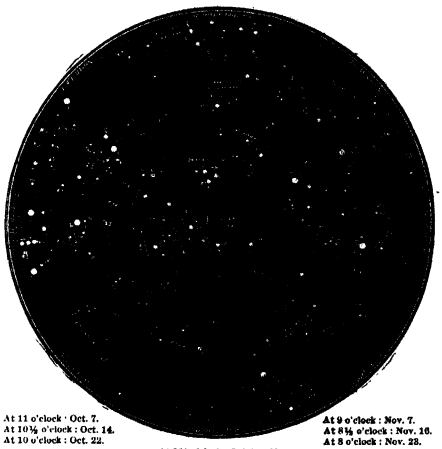
Though less conspicuous to the eye than some other recent comets, notably Halley's, this is really a bigger affair. Had it come as near to the Sun and to us as Halley's comet did, it would have appeared fully one hundred times as bright as it does now and rivaled Jupiter in splendor.

Even in its present remote orbit, it will remain easily visible to the naked eye until the middle or end of November, and will be observable, telescopically, in the morning sky, south of the equator, for many months more, probably until the summer or autumn of 1915.

The Heavens.

We return this month to our usual custom of presenting a map which exhibits the sky as it appears in the latter part of the evening, or in the early evening of the following month. A good starting-point in identifying the constellations will be found in the Great Square of Pegasus, whose corners are marked by four stars of the second magnitude, about 15 degrees apart. At the hours listed at the bottom of this map, this will be just south of the zenith and very high in the sky. Earlier in the evening it will be in the southeast and not quite so high up.

From the northeastern corner of this square, marked by a star which really belongs to Andromeda, runs a conspicuous line of bright stars, spaced at distances about equal to a side of the square. The first of these, Beta Andromedæ, serves as a guide-post to a very interesting object, the Great Nebula in Andromeda. As the map shows, there are two small stars above it, in a line almost at right angles to the main line of bright stars already spoken of. Just above the second of these is the nebula—a hazy patch of light, easily visible to the eye, and more conspicuous in a field-glass. Only photography reveals the great spiral extensions which make this one of the most magnificent objects in the heavens, but even without these it is an impressive object. The



NIGHT SKY: OCTOBER AND NOVEMBER

impression grows, when we consider that its distance is at least as great as that of the nearer stars, and probably very much greater, so that its diameter is probably at least 1,000 times that of the whole solar system, if not greater. Still more amazing is the recent discovery of Dr. Slipher of the Lowell Observatory, who finds, spectroscopically, that the nebula is approaching us at the enormous rate of nearly 200 miles per second—a result now confirmed by other observers. The nebula is apparently almost fixed in the heavens, having little or no proper motion; and, if its velocity at right angles to the line of sight is at all comparable to that of its approach, its distance must be many hundreds of light-years, perhaps thousands, and it must be many light-years in diameter. Its spectrum closely resembles that of the Sun; but how such a gigantic thing can give off light of this sort is not quite clear. It may be a great star-cluster, enormously distant, or one high central star, surrounded by a fog of some sort which reflects its light. We do not know yet, but more light may be thrown on the subject by the observations of the next few years.

Returning to the line of stars with which we started, we pass by the bright red star Gamma Andromedæ into Perseus, which lies in the Milky Way. Below this we find Auriga, with the brilliant yellow star Capella, and above it the zig-zag line of Cassiopeia. The bright patch in the Milky Way between Perseus and Cassiopeia is a magnificent star-cluster, seen well with even a small telescope.

Due east, to the right of Perseus and Auriga, is Taurus, distinguishable at once by the exact but prominent group of the Pleiades and the V-shaped one of the Hyades, lower down. Beneath this Orion is rising, and above and to the right is the flattened triangle which marks the head of Aries. The great dull region in the southeastern sky is shared by this large but not very important constellations Eridanus and Cetus.

The southwestern sky is almost as dull, except for the presence of one bright star, Fomalhaut, in the Southern Fish, and of the far brighter planet Jupiter, which is now in Capricornus.

The three brightest stars in the west are Altair, in Aquila (on the left), Vega, in Lyra (on the right), and Deneb, in Cygnus, above the latter. In the north we find the Great Dipper close to the horizon, right below the Pole, and Ursa Minor and Draco above it and to the left.

The Planets.

Mercury is an evening star all through this month, but is so far south of the Sun that he is very unfavorably placed. He is best observable about the 19th, shortly before his greatest elongation, which occurs on the 15th, but he sets within a few minutes after 6 o'clock, and can be seen only with difficulty.

Venus is evening star in Libra and Scorpio, and is conspicuous in spite of her great southern declination. On the 28rd she passes 1 degree south of Antares, and it will be hard to see even this first-magnitude star so near the brilliant planet, especially as both are very low in the southwest, setting about 6:30 P. M.

Mars is evening star in Virgo and Libra, but is too near the Sun to be well seen. He is in conjunction with Mercury on the 5th and again on the 30th, but both planets will be very low in the twilight.

Jupiter is in Capricornus, coming to the meridian at 8:22 on the 1st and 6:27 on the 31st, and is the chief ornament of the evening skies.

Saturn is in Gemini, rising at 10 P. M. at the beginning of the month and 8 P. M. at its close.

Uranus is in Capricornus, and is almost stationary in the sky during the month, being never more than 3 minutes from a point in 20 hours 41 minutes 16 seconds—18 degrees 80 minutes. He is in quadrature, 90 degrees east of the Sun, on the 31st.

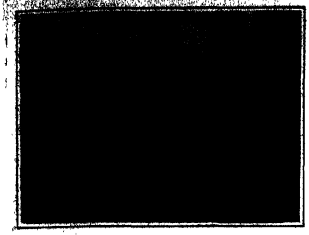
Neptune is in Cancer, and is likewise in quadrature, on the 24th, but is west of the Sun, and observable in the morning.

The Moon is full at 1 A. M. on the 4th, in her last quarter at 5 A. M. on the 12th, new at 2 A. M. on the 19th, and in her first quarter at 6 P. M. on the 25th. She is nearest us on the 10th and farthest off on the 6th. During the month she is in conjunction with Saturn on the 10th, Neptune on the 13th, Mars and Mercury on the 20th, Venus on the 21st, and Uranus and Jupiter on the 26th.

Princeton University Observatory.

Electrical Heating for Buildings

ELECTRICAL heating of rooms, on the hot-water system, is now carried on in Stockholm. In the top story of a building is a heat-insulated water tank of 100 to 300 gallons with electric heating devices for the water. During the night the water is heated up, for the price of current is less at such hours, and in some cases extra low night rates prevail. An automatic device switches off current in the morning and throws on an electric motor pump, and this sets up circulation of warm water in the radiators throughout the building. In the basement is the pump and a small water tank from which the water goes up to the roof tank and keeps up a constant circulation. In the evening the pump is switched off and the current sent to the heater tank, preferably by the use of a hand switch. A heat-storage tank of 125 gallons using 4 kilowatts and 10 hours charging at night will take in heat enough for radiators in 4 or 5 rooms. With a 200-gallon tank and 6 or 8 kilowatts, 8 rooms can be very well heated. It is claimed that the present method is one of the best as well as most economical for use, all things considered, and it is quite automatic in action and does not get out of order.



Open-air cookers for picnickers.

Fire Precautions in a California Park

IN order to reduce the possibility of great damage resulting from forest fires, the city of Los Angeles has adopted the idea of prevention, and has waged an effective campaign along that line.

Through the fine philanthropy of Col. Griffith of Los Angeles, the city recently fell heir to Griffith Park, a natural forest reserve taking in many hundreds of acres of the most beautiful forest trees in southern California.

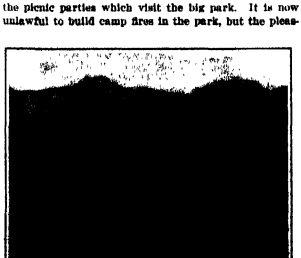
The big park has long been a picnic ground for pleasure-seekers, and in days gone by the trees have suffered seriously from fires rising out of hot beds of coals carelessly left by pleasure parties when they broke camp. The beautiful trees were also damaged occasionally by the burning of trash and brush in sections of the park where trees stood close together.

One of the first things the Park Commissioners did was to have a blacksmith build a brush incinerator for the park. This incinerator is merely a big sheet iron hopper mounted upon a sheet iron wagon box, which served as the firebox. The incinerator has three small implement wheels, one running in front, at the butt of the tongue, to make short turns possible. The incinerator hopper is hooded by a semi-circular piece of sheet iron which is profusely perforated. This hood is so arranged that it can be swung over and made to shield either side of the incinerator. The theory of the thing is that the park attendants drive the brush burner to points where there is brush or trash to burn, and then the hood is turned as required, to serve as a heat and spark shield. In this way the trees are never scorched or endangered while brush is being burned in the park.

One of the other novelties of the forest fire prevention campaign is the open-air furnace and fireless cooker. Both of these objects are made of cement and cobblestones. The furnace is an open firebox with a stone chimney. The fires are fed with waste wood, and the firebox is covered with a piece of heavy woven wire, upon which vegetables, eggs, pots of porridge, meats, or bread can be boiled, broiled, cooked, or toasted. Similarly, the so-called "fireless cooker," which is merely a round stone barrel, may be filled half full of coals from the furnace, after which it can be filled with vegetables to bake, or a pot of partially cooked food can be set within it to be finished off.

These two cooking novelties find great favor among the picnic parties which visit the big park. It is now unlawful to build camp fires in the park, but the pleasure parties no longer care to build them, for their wants have been supplied by the thoughtful Park Commissioners.

The Los Angeles campaign of park forest fire prevention has worked out satisfactorily. Some of the salient features of it might be advantageously applied in other localities where there are splendid forests to be protected against the danger that frequently arises from visits of careless hunters and pleasure seekers.

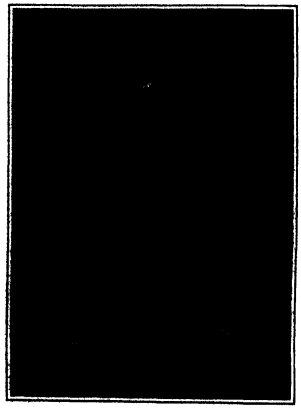


A natural bridge in Argentina.

Monument for Capt. Scott

THE committee appointed to select a design for a monument for Capt. Scott and his associates who sacrificed their lives in their endeavors to reach the south pole and explore Antarctic regions, has finally chosen for execution the model submitted by Albert H. Hodge.

A photograph of the model is reproduced herewith. It personifies "Courage," crowned by "Immortality." The reliefs on the sides represent the following subjects: On the north side, "To Strive," showing the difficulties encountered on the journey; on the south, "To Seek," showing the start for the pole; on the east, "To Find," showing the party at the pole; and on the west, "Not to Yield," showing the snow-covered tent, which was the last resting place of the explorers.



Monument for Capt. Scott, the Antarctic explorer.

Gas Batteries

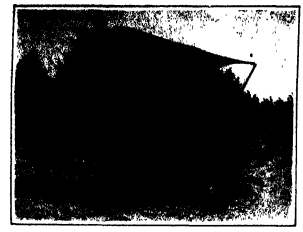
By Harry N. Holmes

GAS cells of many types have been invented, but they all are closely related to the fundamental type. Two tubes with electrodes of platinum sealed in the walls are inverted in a cup of hydrochloric acid, for example. If the tubes are filled with hydrogen and chlorine gases, respectively, and so arranged that the platinum electrodes are partly covered with gas and partly covered with acid solution, we have a simple gas battery. Connect the electrodes by a wire and a current will flow through the circuit. At the same time the gases will go into solution. Of course if built as directed the battery would soon run down, but inlets for a continuous supply of gases could easily be made and a steady current of electricity drawn from the device.

The scientific explanation involves reference to the ionic theory, but is really quite simple. Hydrochloric acid in water solution breaks up into charged particles called ions. The hydrogen ion carries a positive charge and the chlorine ion a negative charge. Now the hydrogen gas which is not charged and not ionized has a tendency to pass into solution, but this it cannot do without becoming ionized. Therefore it takes the needed positive charges from the platinum electrode and goes into solution, leaving the electrode negative. At the other electrode the opposite is happening. Chlorine gas tends to pass into solution, but to do so it must become ionic. The needed negative charges are taken from the platinum pole, leaving it positive. With one pole positive and the other negative, it is evident that an electric current will flow through a connecting wire. A feature to be noted is that the osmotic pressure of the ions already in solution exerts an outward push or opposing force, which finally becomes great enough to stop further solution of the gases unless the liquid is steadily removed and a weaker solution caused to replace it. However, that is a mere mechanical detail.

Other gases such as hydrogen and bromine or hydrogen and iodine or hydrogen and oxygen, and many other combinations, may replace the first named pair, the only requisite being that the two gases will react with each other. Hydrogen and oxygen, for example, will unite in a flame to form water, and this same reaction takes place when they are used in forming a gas cell, though there is no flame, the energy appearing as electricity instead of heat. Any solution that conducts electricity well will serve instead of the hydrochloric acid mentioned in the original illustration. Water gas and air are easily obtained commercially, and will contain the oxygen and hydrogen of one variation.

The Junger cell is somewhat different from the above, and yet it is a gas cell. A bar of iron is placed in the bottom of a glass jar, which is filled with a water solution of some salt such as ammonium chloride or sulphate. Above this is a porous cup filled with a carbon rod surrounded by lumps of graphite. Air to furnish oxygen is pumped into the porous carbon and a current is found to flow in the cell from iron to carbon.



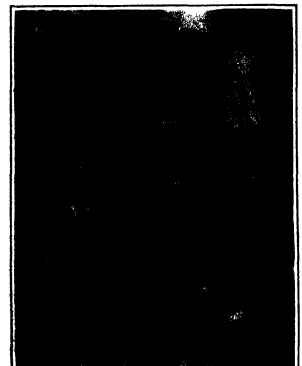
Portable incinerator for burning brush.

A Remarkable Natural Bridge

IN Argentine there is a natural bridge that is one of the most wonderful in the world. It spans the Rio Mendoza and is known as the Inca Bridge. But it is the work of Nature, and not, as was popularly supposed, of the Incas. The road on which it occurs was probably a colonial highway made by the Peruvian Incas, who took advantage of the phenomenon by leading their road over this natural viaduct.

Glass Paving Blocks

A NEW use for the glass dust that collects in glass works has recently been discovered in Berlin. The dust is gathered up and placed in a furnace where it is reduced to molten "lava." The lava is then run into molds the size of a paving block. The glass bricks thus formed are found to be as hard as granite and eminently adapted for paving, giving a smooth and strong street surface. The accompanying photograph shows the filling of a mold. The man at the right is controlling the flow of the glass by operating a valve.



Making paving blocks from glass dust.

The Motor-driven Commercial Vehicle

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The Editor will endeavor to answer any questions relating to mechanical features, operation and management of commercial motor vehicles.

Dumping Truck With Swinging Crane

TO clean out the sediment deposited in sewers a tripod derrick is usually set up over a sewer manhole and the sludge is raised with buckets hauled up by a gang of men. As this is a slow and laborious process the Bureau of Sewers of the Borough of the Bronx, New York, has had a special motor truck built with a swinging crane and a large water-tight dumping body. The truck is run along side the sewer manhole and then with the crane, which is operated by power from the truck motor, it is possible to raise and dump into the body a bucketful of silt weighing a ton and a half. The body has a capacity of 3½ cubic yards. In dumping it may be raised to an angle of 60 degrees.

The hoist consists of an upright about 8 feet above the floor of the truck, with an arm extending out, which gives the crane an effective radius of 8 feet. This crane is operated from the clutch shaft and controlled by a lever which is directly behind the cab, within easy reach of the driver. It is possible to rotate the crane by hand so that material can be picked up from either side of the truck. The crane rotates from 200 to 220 degrees. With the propeller shaft revolving at 600, the crane has an effective hoist speed of 20 feet per minute. The truck is equipped with a 50 horse-power motor.

A truck of this type offers many possibilities in the trade. It can be designed with either a platform rack, or dump body for carrying any commodity that can be picked up with grappling hooks or gathered up in a bucket or scoop. With the power crane it should make easy the handling of such diverse material as cut stone, bales of cotton, castings, etc.



Truck for cleaning sewers, equipped with swinging crane and dumping body.



Baltimore's motor truck, with radio equipment, for keeping in touch with the "trouble crew."

Front-drive Tilting Tractor

A NEW front-drive electric tractor has made its appearance which is particularly adapted for the lumber business. It is driven and steered by two wheels with an electric motor in each wheel driving at a single 25 to 1 reduction in balanced action at the periphery of the wheel.

The tractor frame extends back of the battery box about 5 feet, and the two ends of this frame are beveled upward. Metal pockets are placed underneath the floor of each of the trailer wagons, having end openings flared both downwardly and horizontally.

In the lumber business, one tractor serves from three to six trailer wagons, according to the length of the hauls. The trailer wagons retain the upper half of the original fifth wheel in front. During the operation of loading, the ordinary front axle construction is used with horses hauling the load. Half of the fifth wheel is used, in connection with horses to drag the wagon to and fro to be loaded. After loading, the wagon is placed in some convenient spot, and a horse or jack put underneath the perch, and the front axle removed. It is then ready for the trailer to couple on.

The tractor when detached is supported by its front driving wheels, and two small rear auxiliary wheels. All four wheels are mounted on springs. The flared ends of the trailer pockets being cornucopia shaped, are very easy to engage. When the beveled ends of the tractor frame strike the lower part of the front incline of the pockets, the tractive power of the front driving wheels pushes the rear frame extension up the incline of the pockets and back into position. The small auxiliary rear wheels of the tractor are then about 6 inches from the ground. An ordinary hook coupling with turn buckle is used on each side to firmly couple the tractor and trailer together. The operation of coupling and uncoupling a trailer is quicker than the same performance with horses, or ordinary tractors. When the tractor is detached, the center of gravity is placed well back of the front axle and enough weight is on the small rear wheels to preserve the stability of the machine. However, in case a reckless operator should stop too suddenly, going down grade, or be brought up by a deep hole, stump, or curb, any tendency to tip forward is taken care of by the rounded pair of skids brought down under the footboards in front.

The battery is placed on top of the frame back of the driver's seat, and is readily removable in a single unit by means of an overhead chain hoist and rail. In the lumber business, the hauls are long, and the loading and unloading very quick, so that high mileage with a tractor is possible. Two batteries are, therefore, furnished with each tractor, changeable at noon. The device has a capacity of three tons pay load, and speeds of from 6 to 8 miles per hour, which in the lumber business are the economical speeds. It is also made to haul 5 tons at 5 to 7 miles per hour.

The driver's seat is equipped with spring cushions, and is placed low down on the front end of the frame, with dropped foot boards, enabling the driver to sit under the forward ends of the long sticks of timber; with a top and storm front to protect him from the elements.

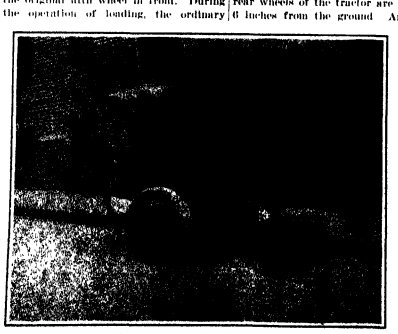
The pockets for the tractor can be readily applied to almost any type of wagon, and the majority of the time usually spent in loading by hand saved.

Emergency Truck With Radio Equipment

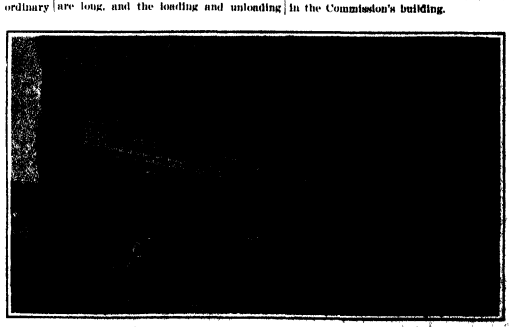
FOR the purpose of maintaining the municipal conduit system, the Electrical Commission of the city of Baltimore, has had constructed a specially designed and equipped auto-truck which has recently been placed in service. The most unusual and interesting feature of the outfit is the wireless telegraph equipment, through the agency of which the department is able to keep in constant communication with its trouble crew, so that all emergency calls can be handled with the greatest dispatch.

The truck serves as a receiving station only. The antenna is suspended immediately under the roof of the car, and is made of about 425 feet of No. 14 stranded rubber-insulated copper wire, which was laced back and forth until forty wires were strung with a separation of 1 inch. The aerial is, therefore, inconspicuous and well protected.

A series of rigid tests has proved conclusively that the scheme is entirely practical and that excellent results can be obtained, without resorting to the employment of trained operators, through the aid of a simple code of signals. It has also been demonstrated that a direct earth connection is unnecessary, inasmuch as the iron framework of the chassis serves admirably as a counter-poise ground, thereby enabling the truck to receive while in motion. During all of the preliminary tests the truck never failed to intercept any message sent to it within a radius of 10 miles of the sending station, and under the most unfavorable conditions, with the truck running at full speed and blanketed by tall buildings of steel construction no difficulty was experienced in reading the messages. A regular service is maintained between the truck and a 1-kilowatt station in the Commission's building.



Electric front-drive tilting tractor.



The tilting tractor coupled to a trailer loaded with lumber.

LEGAL NOTICES

PATENTS

If you have an invention which you wish to protect you can safely entrust your business to Munn & Co., for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

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Signal and telegraph service.
Medical and ambulance service.
How the vast armies are fed in the field.

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361 Broadway, New York City

Motor Truck Notes and Queries

J. N. D. writes: "At what speeds could a three-ton truck be driven without inducing undue strain or wear on the different parts of the vehicle?"

A. Ten or 12 miles an hour under load is usually considered to be the safe speed of a truck of this size. In the case of fire apparatus, of course, such speed must be greatly exceeded, and as the engines, water towers, and hook and ladder trucks may represent a weight greater than a three-ton truck at full load, the vibrations induced would be excessive if the ordinary type of solid tires were used. For such purposes, therefore, pneumatic tires are almost universally employed, and with these a truck of the size that you mention may be driven at speeds from 15 to 25 miles per hour, provided the gear ratio has been properly designed. Many lighter delivery trucks that are run at speeds of from 15 to 20 miles per hour, are provided with pneumatic tires in front and with cushion or solid tires at the rear where the wear is greatest. Such trucks, however, are seldom larger than three quarters or one ton capacity.

N. A. E. writes: "I understand that the leaf springs of a truck should be lubricated occasionally. How is this best done, and what kind of lubricant should be used?"

A. The leaf springs of a truck or pleasure car are too often neglected by the owner or chauffeur. With each deflection and rebound of these springs, portions of the individual leaves are subjected to a sliding motion. Furthermore, water may occasionally find its way between surfaces of adjoining leaves, and the rust that will accumulate will add to the friction and resulting wear. A heavy oil or light grease, to which has been added a sufficient amount of graphite to make a black paste, serves as a satisfactory spring lubricant, and may be applied after the leaves have been separated, by means of a thin knife blade. The easiest way to separate the leaf springs is to jack up the car from the body so that the weight of the wheels and axle is suspended from the springs. However, if you desire, you can obtain one of the several spring wedges that are on the market, and which serve to separate the individual leaves of springs by means of a clamp and wedge arrangement.

P. L. K. writes: "I noticed a reply to an inquiry recently in which you mentioned a new method of burning carbon from the cylinders of a motor. Please describe the theory more in detail, and explain why the intense heat does not injure the motor."

A. The free carbon found in the interior of a motor is not combustible under ordinary conditions. As you doubtless know, however, oxygen is a supporter of combustion and materials that cannot be ignited in the open air will burn freely in free oxygen. Therefore, by introducing an especially designed blow-pipe, connected with an oxygen tank, into cylinders of a motor, and applying a torch, the carbon will be burned completely, and combustion will continue until the cylinders are absolutely clean. When the carbon has been consumed the flame, of course, dies out, for oxygen is not inflammable, and is merely a supporter of combustion. When the carbon is burned from the cylinders it is necessary to make certain that the piston is at the top of its compression stroke, when both valves will be closed. It is, furthermore, necessary that the circulating system should be full of water so that the heat generated by the burning process will be more easily dispelled.

G. D. N. writes: "What is the simplest method for determining the approximate horse-power developed by the 4 by 5 motor in my truck?"

A. Probably the simplest method for determining the approximate horse-power developed by a motor is what is known as the S. A. E. formula, which states that the horse-power of any motor is equal to the square of the bore, multiplied by the number of cylinders, and divided by 2½.



SAY—are you interested in the best Hand Vise that was ever made? Take a look at this one, with parallel jaw faces; they are always parallel whatever the position of the Vise. It is drop forged too. Nothing else like it on the market. If you have any use for a tool of this kind you can't afford to be without one. It only costs you $1.25, postage paid; 4½ inches long, weighs 15 ounces; jaws open 1⅜ inch.

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Makers also of Herringbone Metal Lath, the Standard metal lath

Self-Sentering is different You'll know it by its Diamond Mark

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War News and THE CENTURY

(PRELIMINARY ANNOUNCEMENT)

Beginning with the November number, THE CENTURY MAGAZINE will interpret to its readers what lies back of the bare facts of bulletin and despatch. A notable group of CENTURY contributors is already engaged on this important work.

In New York W. MORGAN SHUSTER and SAMUEL P. ORTH of Cornell will write of the war and its effects from an ethnic and political point of view.

JAMES DAVENPORT WHELPLEY, now in London, will deal with the personalities of the war lords and the spirit of the nations.

ESTELLE LOOMIS, the brilliant short story writer, now in Paris, will be sending THE CENTURY sketches of vivid human interest.

ALBERT BIGELOW PAINE, now in Switzerland, has put himself in touch with the German authorities with a view to presenting views of Germany in war time.

DR. HENDRIK VAN LOON, historian and journalist, has gone to his native land, Holland, where he will write of the Lowlands in war time.

ALBERT EDWARDS, the well known novelist and travel writer, is to leave for Europe in the near future with a roving commission from THE CENTURY MAGAZINE. His mission is to help build the literature that will grow out of the war itself.

JAMES LANE ALLEN'S new novel, "The Sword of Youth," will begin in the November CENTURY—a stirring story of war times.

A special offer to new subscribers of The Century:

Fifteen months for $4.00—October, November, and December free, and one year's subscription, beginning with January, 1915.

THIS COUPON WILL BE A VALUE OF $1.00

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This offer to new subscribers only.

This formula is used for determining the rated horse-power of a motor as a basis for State taxation, but in view of the improved workmanship and better design of modern motors, it is no longer accurate. The piston displacement, or volume displaced by all the pistons during each stroke, should determine in a fairly accurate manner the power capabilities of the motor in question. Some manufacturers claim one horse-power for each 5½ cubic inches of piston displacement, while others are more conservative, and consider one horse-power to be obtained from each 7 cubic inches of piston displacement. We could probably obtain fairly accurate results by assuming that the modern pleasure car motor delivers a horse-power for each 6½ cubic inches of piston displacement, and the truck motor, because of the more careless handling to which it is subjected and less efficient conditions under which it must be operated, delivers one horse-power for each 7 cubic inches of piston displacement. As the motor of your truck would have a piston displacement of 252 cubic inches, you will see that the approximate horse-power developed by it, by the application of the above method, is 36.

The United States Battleship "Pennsylvania" and Class

(Concluded from page 244.)

of the forward turret. On the main deck aft are two three-gun turrets, similarly disposed. This gives a concentration of six guns ahead, six astern, and a broadside fire of twelve guns.

The three guns in each turret are mounted in a common sleeve and are elevated, trained, and fired as one gun. This greatly assists the spotter in locating the fall of the shots and making the corresponding corrections in the elevation. Moreover, it effects a considerable saving of weight.

An excellent feature is the great height at which the amidship battery of 5-inch, torpedo-defense guns is carried. There are twenty-two of these guns in all. Four of these are mounted in casements on the main deck forward; four in casements on the gun deck aft; ten in a central battery on the forecastle or spar deck, and four on the boat deck above the central battery. This arrangement gives a concentration of eight 5-inch guns forward and aft and eleven on each broadside.

The armor protection is unusually extensive and of greater weight and thickness than that of any ship under construction for other navies. The belt armor will have a maximum thickness of not less than 14 inches, and the gun positions will be similarly protected, the front plates of the turret being 18 inches thick, the protection of the barbettes being in proportion. The water-line belt will extend over eight feet below the water-line, and the whole side of the ship to the main deck will be heavily armored. With the side armor will be associated heavy transverse armor bulkheads and several horizontal armor decks.

The battery of water-tube oil-fired boilers will be contained in a set of separate, heavily bulkheaded boiler rooms, extending clear across the ship and served by a single smokestack, the base of which will be protected by heavy inclined armor, this to protect the uptakes against penetration, and thereby prevent the furnace gases from passing into the 'tween decks, as happened, disastrously, to the Russian ships in the battle of Tsushima.

The dimensions of the ship will be as follows: Length on water-line, 600 feet; length over all, 624 feet; breadth, 97 feet; draft, 30 feet; displacement, 32,000 tons. She will be provided with four submerged 21-inch torpedo tubes, and her complement will consist of 1,056 officers and men.

The cost of the ship, exclusive of armor and guns, will be $7,800,000, and the ship when complete will have cost about $15,000,000. She was laid down in February, 1913, and is due for completion in February, 1916.

The "Pennsylvania" will be turbine-driven and her contract speed is to be 21 knots.

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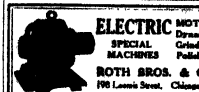
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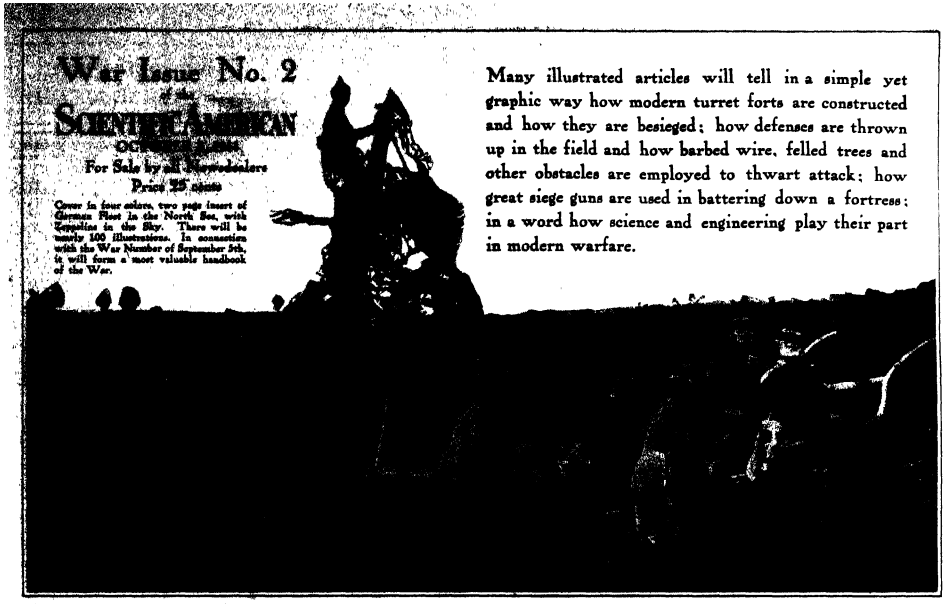
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DAY after day the Germans pumped shot and shell upon the fortifications of Liege. But the forts held out bravely. "Wait until our heavy siege artillery comes," said the Germans. When it came, the forts crumbled.

They must have been very wonderful forts that could hold out so dauntlessly, and they must have been very wonderful guns that ultimately reduced them. In the October 3rd issue of the SCIENTIFIC AMERICAN you will learn all about these forts (there are many more like them along the French-Eastern frontier), and all about the big guns that cracked them.

The Gruson Turret Fort

Military men call these Liege defenses and others of their type "Gruson Turret Forts." Curiously enough they are of German design, and fittingly enough it took German guns to reduce them.

Major A. Piorkowski, a well-known German expert on ordnance, has written, for the October 3rd issue of the SCIENTIFIC AMERICAN, a very instructive article on this Gruson Turret Fort. He takes you by the hand, as it were, and leads you through underground passages to the ammunition hoists, and eventually into the steel turret itself, and shows you its operating mechanism and its powerful weapons.

Huge Siege Guns of the Germans

The huge siege guns before which the turret forts succumbed will receive their attention in another article. In a magnificent colored cover, which will enclose the entire issue, one of these destructive giants is pictured in action. The issue will also present other pictures of siege artillery, and will explain in the SCIENTIFIC AMERICAN's characteristically lucid way what may be expected of them.

Fortifications in the Field

How was the German onslaught met in pitched battle? Defenses of some kind, as well as gun fire, were necessary. Every obstacle that can be conceived was thrown into the path of the onrushing German infantry. The barbed wire fence and felled trees with great protruding branches must have proved formidable barricades. The full nature of these defenses, which make it as necessary for an infantryman to carry wire cutting tools as guns, will be set forth.

Submarine Mines and How They Are Constructed

Perhaps a dozen or more neutral merchant vessels have been blown up by mines in the North Sea. They are terrible instruments of destruction, these mines. A tramp steamer, or a battleship for that matter, steams along through a sea that betrays nothing of the explosives hidden beneath its waves. Suddenly the ship's bottom touches the top of the mine. It is as if the trigger of a gun loaded with hundreds of pounds of deadly explosives had been pulled. The explosion is terrific; the destruction complete. How are these mines constructed? Why are they so deadly? The SCIENTIFIC AMERICAN'S war issue No. 2 will tell.

The Mechanism of a Submarine Boat

The submarine boat will also receive its share of attention; for the submarine is bound to play its part in the present conflict. As you read the SCIENTIFIC AMERICAN'S article on submarines, their intricate mechanism will be picked apart for you, as it were, just as if they were so many watches. Engines, trimming tanks, periscopes, torpedo tubes, in a word, all the wonderfully compact machinery of the submarine will be revealed.

There will be other articles too, in this issue—articles of a constructive nature.

Our Trade Opportunity

John Barrett, director of the Pan-American Union, will point out to the American exporter just what the war has done for him in opening up foreign markets that have hitherto been closed to Americans. Letters from prominent financiers, business men manufacturers, will also be published—all of them men worth heeding—whose opinions will form a fitting supplement to Mr. Barrett's exposition.

The Eight Cylinder Cadillac

Eight power impulses in every cycle—overlapping so completely that they melt and merge, one into another, in a steady flow of power

This is the story, in a single sentence, of the Eight-Cylinder Cadillac.

Complete continuity—not theoretical, but actual.

You can figure the effect of this overlapping of power impulses as well as we can describe it.

You can imagine it, that is,—from what you know of comparative or approximate continuity.

But your imagination will fall very far short of the facts.

You have never had a ride such as your first ride in the Eight-Cylinder Cadillac will be.

You have doubtless discerned that different types of motors produce different sensations in riding.

But none of these differences are so pronounced as the difference which exists between this Eight-Cylinder motor and all other types.

When scientists and mathematicians cannot carry a calculation to a higher, or to a finer point, they say it has reached the n^{th} degree.

This Eight-Cylinder Cadillac carries the principle of continuous power to the n^{th} degree.

It produces eight power impulses during each complete cycle; four power impulses during each revolution of the fly-wheel—one every quarter turn.

What follows is not merely a revelation—but actually a revolution in riding results.

It is infinitely more than a matter of simply furnishing greater power.

It is the velvety way in which that greater power is furnished by the Eight-Cylinder Cadillac which overturns all your previous conceptions of motoring.

We said in the caption that the impulses overlap so completely that one melts and merges into another.

That is literally true.

We said that this produces a steady flow of power.

That is also literally true.

But this is only a part of the truth—and a very small part.

The power ebbs and flows so flexibly that the car can be operated almost continuously under throttle control, without change of gear.

The steadiness of its application imparts a like steadiness to the car itself.

After your first ride in the Cadillac Eight you will revise your idea of what constitutes freedom from vibration.

You will revise your idea of efficiency at high speed; and of efficiency at low speed.

When you climb a hill you scarcely feel as though you were climbing a hill at all.

You will be more apt to feel, instead, that the hill has accommodatingly subsided into a level roadway.

The fluid flow of uninterrupted power gets better riding results out of all kinds of roads.

If the road be level, and good, the Cadillac Eight extracts from it a new and a superlative smoothness.

If it be rough and uneven, the steady, unbroken torque minimizes the jolts and jars.

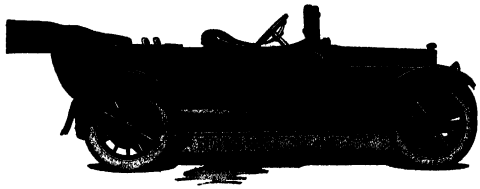
The motor does not seem to be driving the car, but rather to have given it wings.

It is difficult to treat the subject in calm and temperate terms in view of the impressive fact that this Eight-Cylinder Cadillac has created a new kind of motoring.

We can see nothing ahead but a demand so overwhelming that it will be impossible for the Cadillac Company, within a year, to satisfy that demand.

Styles and Prices

Standard Seven passenger and Five passenger cars, Four passenger Salon and Roadster, $1975 Landaulet Coupe, $2500 Five passenger Sedan, $2800 Seven passenger Standard Limousine, $3450 Berline type Limousine, $3600 Prices F O B Detroit.



Seven Passenger Touring Car (illustrated) with Eight Cylinder V Type Engine

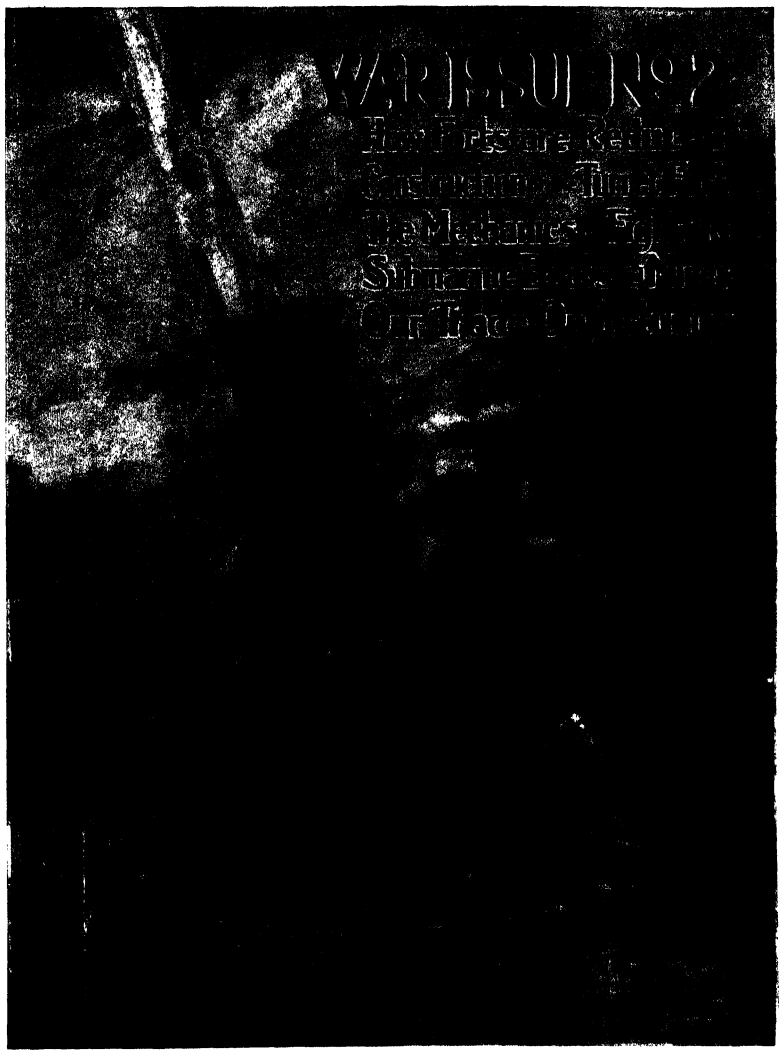
Observe that the Power Plant does not demand a hood of abnormal proportions

Dealers will have demonstrating cars in the near future

Cadillac Motor Car Co. Detroit, Mich.

WITH SUPPLEMENT SHOWING GERMAN FLEET

SCIENTIFIC AMERICAN



Vol. CXI. No. 14
October 3, 1914

Munn & Co., Inc., Publishers
New York, N. Y.

Price 25 Cents
$3.00 A Year

Of Interest to All Who Plan to Spend $1000 to $2000 for an Automobile

We know that you want to get the best possible car for your money. No man conscious of buys a cheap car

So this advertisement is written to give you a few facts to keep in mind when investigating the merits of different cars

For seven years Chalmers cars have ranked first among the medium priced cars in America. For two years Chalmers "Sixes" have led all medium priced Sixes in volume of sales. Over 40,000 Chalmers cars are now in service

The Chalmers Company is recognized as one of the strongest companies financially in the industry. Chalmers cars have probably to a greater degree than any other make always influenced the trend of automobile building in the medium priced class

Certainly these facts entitle this advertisement to a careful reading

We expect you to investigate carefully every statement we make here and we urge you also to study all cars which sell between $1,000 and $2,000

In the first place, we ask you to see the Chalmers "Light Six." Don't simply look at it and listen to the story of an enthusiastic Chalmers salesman, and then go look at another car and listen to the story of another equally enthusiastic salesman. You are not buying conversation

But ask any Chalmers dealer to stand the Chalmers "Light Six" alongside any Light Six selling at any where near its price—$1650. Study the cars yourself

First Looks. How do other cars compare with the Chalmers. "Light Six" in style? The Chalmers has a ***real*** streamline body. The flat or merely crown fenders of the other cars have not the grace of the Chalmers' molded oval fenders. Chalmers door- are wide and flush fitting. Chalmers running boards are clear

And don't under-estimate this matter of looks. ***Half the pleasure of motoring is being proud of your car,*** and good looks really mean high quality

Second. See which car is most substantially built. Thump on the body with your knuckles. The metal in the Chalmers body is heavy. It will never sound tin-panny. It is rigid. And because of these qualities its flush seams last

Test the weight and solidity of the fenders. You can sit on the Chalmers fender and not injure it. It does not vibrate, and after months of strenuous use it does not rattle

Looks and stability are two of the big reasons why we have been behind on orders for the 1915 "Light Six" ever since it was announced

Sit in the front seat. Take hold of the gear shift lever and emergency brake lever. They feel strong and dependable

And while you are in the front seat, test the comfort of the driver. You sit in a natural, easy position. The clutch and brake pedals are easy to reach. Your hands rest comfortably on the steering wheel. Put your foot on the accelerator. You do not have to assume a cramped position, but can operate it easily. ***The Chalmers accelerator is grounded with a foot rest. Hundreds of owners of other cars have told us that this detail alone is worth $100 extra cost in a season's driving.*** Now sit in the back seat. Test its roominess and comfort

In comfort, the Chalmers "Light Six" is the equal of any car of its size at any price. Many former owners of higher priced cars now drive Chalmers "Light Sixes," and they all say ***comfort was a big factor in their selection of the Chalmers***

Remember you are buying a car to ride in. You are not always going to drive on asphalt pavement. You are not going to use your car simply for thirty minutes or for five miles. But you are going to ride practically every day for two or three or possibly five years in the car you buy. You are going to travel thousands of miles and over all kinds of roads

So don't take a mere "demonstration" in any car. Demand a test. Any Chalmers dealer will be glad to take you for a twenty-five or thirty mile trip in the country. He will give you a real test lasting two or three hours or a day if you choose. Demand this same test of any other car

And compare what the salesman tells you while you are riding with your own experience. Think about the comfort of the car. Ask yourself if you would be willing to ride twenty thousand miles in that car

Note how the Chalmers "Light Six" clings to the road. Preferably drive it yourself

The Chalmers "Light Six" has a big substantial steering wheel. The steering connections are heavy, free moving tongings. The front steering spindles are equipped with Timken bearings. It is free from side sway and easy to steer

Many "Light Six" owners tell us this 1915 Chalmers handles easier than any other car on the market. That feature alone has sold hundreds

And notice too the sound of the motor as you ride along. Notice when you start that the first speed gears don't shriek out the fact that you are in motion

Ask the demonstrator to drive twenty miles an hour on second speed. Note that both motor and gears are quiet. Pick out some hill and ask the Chalmers "Light Six" and any other car in its price class to go up that hill at fifteen miles an hour

That long, strong pull of the Chalmers motor has proved one of it most popular features with the motor-wise

On a rough stretch of road notice that the Chalmers body is firm and dependable beneath you and is free of rattles

The Chalmers medium weight makes it ride like a Packard car on all ordinary roads. When you drive a Chalmers "Light Six" you feel that your car has the strength to be safe in any emergency. Your own ease of body and mind tells you that its medium weight gives it a comfort that cannot be found in a lighter or flimsier car.

We could build the Chalmers "Light Six" lighter in weight. And if our service to you ended with delivering a car and taking your money, we could make a greater profit by building our cars lighter. For every additional pound of fine steel we put into the Chalmers "Light Six" increases its manufacturing cost

You hear a lot of talk about flexibility but very few cars really have it. The real test of flexibility is to start from a standstill in high speed without jerking or pulling, to travel along at two miles an hour on high, to travel through congested traffic without gear shifting

All these things you can do in a Chalmers "Light Six."

And when you get back from your test ride, take a look at some of the axial parts of the Chalmers chassis.

Look at the rear axle. The Chalmers has a full floating rear axle with heavy pressed steel housing. It is big and strong. Look at the Chalmers torque tube. It is securely bolted to the big heavy frame on one end and the rear axle on the other end. ***It takes up all the strains of driving.*** When you were out on the country road you probably noticed that the Chalmers "Light Six" did not sway from side to side. This is because the torque tube held it rigidly in place.

Look at the wheels. The wheels of the Chalmers "Light Six" have spokes 1¼ inches in diameter. They are built of the best hickory. The spokes are securely bolted. ***They look strong and they are strong.***

Notice the length and width of the Chalmers springs. The main leaf is of Vanadium steel. Note their flexibility; remember how they cradled the car over the bumps when you were riding on the heavy country roads

Look at the front axle. You will see that the Chalmers "Light Six" has a heavy drop forged front axle that shows its strength at a glance

Lift the bonnet and look at the motor. It is shiny-shape, finely finished, compact and business-like in appearance. Raise the floor boards and examine the lesser works that you don't usually see in a motor car. You will find the Chalmers "Light Six" simple in every detail but big and strong to stand the hard knocks of constant service

Now for the details. the refinements which make motoring a real pleasure or a constant irritation

To start the Chalmers "Light Six" you throw a single switch. There is no grinding of gears, no noise. You throw the switch and the next thing you hear the motor purring along under its own power

Note too that the Chalmers starter is always connected with the motor when the car is running. Suppose you accidentally shut off the gas—***your Chalmers motor doesn't stall.*** The starter is always on the job. There is no interruption of motor service. No levers, buttons or adjustments to fuss with

You sit behind the wheel of the Chalmers "Light Six" and everything necessary for the control of the car is right in front of you. There is a dash adjustment for the carburetor. There is a simple electric light switch, not a row of buttons to be remembered but the lamps are separately, simply a single switch that controls all of your lights. There is the battery indicator that always informs you of the condition of your storage battery. There is the oil pressure gauge that tells you your motor is oiled well. There is the ammeter for starting in cold weather. There is the gasoline gauge always informing you without fuss of the amount of fuel in the tank

And speaking of gasoline tanks—notice that the tank in the Chalmers "Light Six" is of very heavy gauge steel. You find it holds 18 gallons when most cars carry ten or twelve

The perfect convenience of the "Light Six" is one reason this is the fastest selling Chalmers model with women as well as with men

Notice the adjustment of the windshield. The one-man top, the quick acting storm curtains, the fine and inconspicuous door handles

And now you are ready to hear a talk on "economy." Some salesmen will probably tell you that his car is lighter than the Chalmers "Light Six" that it doesn't burn as much gasoline that it is easier on tires.

A part of what he says is true. But only a part; for a lot of this talk on gasoline consumption is conversation. Don't test your gasoline consumption for 5 mile or 10 miles—don't test it on the boulevard or with special gasoline. Try it out for 50 or 60 miles over all kinds of roads

The Chalmers "Light Six" may cost you $10 or $15 or more for gasoline in 10 000 miles of driving than a too light flimsy car, but it will cost you a lot less in repair in personal discomfort in nerve irritation. You will find that the extra weight of the Chalmers "Light Six" will save you in comfort and repair bills many times the slight additional cost of the gasoline you burn

What the other salesman tells you about tire mileage is probably grossly exaggerated because of his own interest. You will notice that ***the Chalmers "Light Six" has 6" inch tires with "Nobby Treads" on the rear wheels*** where most other Light Sixes in its price class have 4 inch tires

We have never had a complaint on tire service from a Chalmers "Light Six" owner.

You'll also hear something about prices. You'll be told that you don't need to pay $1650 for a Light Six.

Well, you don't. But if you pay less than the Chalmers price, you must expect to get less quality

And speaking of price, here's the only sane way to look at it.

Divide the first cost of your car by five.

Automobiles that are properly built should last at least five years. That is they should stay put run well and give good service for that time. So when you examine a car in the future and are told how much less it costs than a Chalmers "Light Six" ask yourself, "Will it last me five years?"

Figuring any car you are considering on a five year basis see if the facts above don't prove the Chalmers "Light Six" the lowest priced car quality considered on the market.

Yes, you are right - we want to sell you a Chalmers. But we don't ask you to buy until you have proved all the claims we make in this advertisement. The only way for you to get such proofs is to see the car itself. You will be under no obligation if you go to see the 1915 "Light Six" and try it out and you owe it to yourself to know all about this car before you buy any. All we ask is that you give you have a fair chance & afford the opportunity to demonstrate in detail the points of superiority of the Chalmers "Light Six" that we have told you about here

Chalmers Motor Co., Detroit

CHALMERS MOTOR CO. Detroit, Mich. U.S.A.

Quality First

"Light Six" **$1650** ***Fully Equipped***

6-Passenger Touring Car, $1725 **Coupelet, $1900**
7-Passenger Limousine, $3200 **Sedan, $2750**

Prices Quoted f. o. b. Detroit

CHALMERS MOTOR CO. Detroit, Mich. U.S.A.

Quality First

$930,000 Per Week Paid for HUDSON Cars

$235,600 Paid by Users in One Day

On September 15—the day before this is written—dealers sold to users 152 HUDSON Six-40's. That is, yesterday buyers of new cars paid out $235,600 for HUDSONS.

The average has long been $930,000 per week—because that is the limit of output. We are building and selling 100 per day. That is five times as many—*five times, mark you*—as we sold at this season last year. And we had no war then. Our average sales have more than trebled since August 1st.

Means That Hudsons Rule This Field

In July—when we brought out this new model—we trebled our output to cope with demand. Thirty days later—despite our best efforts—we were 4,000 cars oversold.

We shipped by *express* nearly 1,000 cars to minimize delays. That is unprecedented. But thousands of men waited weeks for this car when other cars were plentiful. No other could satisfy men who once saw this new-model Hudson Six-40.

Five-Fold Increase An Amazing Thing

Consider that the HUDSON has long been a leading car. Every model for years has been designed by Howard E. Coffin. He has brought out in these cars all his new advances. And the demand for his models—long before this Six-40—gave HUDSONS the lead. The first HUDSON Six, inside of one year, made us the largest builders of six-cylinder cars in the world.

Think what a car this must be—this new HUDSON Six-40—to multiply this popularity by five in one year. And to do it at a time like this. Think how far it must outrank all the cars that compete with it. Think what a tremendous appeal it must make to car buyers.

Think how it attracts—how it must excel—when in times like these they pay $930,000 per week for it. And they would have paid more had we had the cars to deliver—as shown by yesterday's sales of 152 cars.

The Hudson Six-40 is today the largest-selling car in the world with a price above $1,200.

See the Car That Did It Howard E. Coffin's Best

Go now and see this model—the car whose record is unmatched in the annals of this line. You will see a quality car sold at a price which is winning men by the thousands from lower-grade cars.

You will see a class car—in many respects the finest car of the day—sold at one-third what class cars used to cost.

You will see how clever designing and costly materials have saved about 1,000 pounds in weight. And in this light car—the lightest seven-seat car—you will see one of the sturdiest cars ever built. You will see a new-type motor which has cut down operative cost about 30 per cent.

You will see new beauties, new ideas in equipment, new comforts, new conveniences. You will see scores of attractions you have never seen before.

They are all in this masterpiece of Howard E. Coffin, who has long been the leading American designer. This is his finished ideal of a car, and many count him final authority.

Mr. Coffin has worked for four years on this model, with 47 other HUDSON engineers. Part by part, they have refined to the limit every detail of the car

This is the acceptable proven type This lightness, beauty, economy and price are new-day standards which men are demanding. And this quality—Howard E. Coffin's level best—is the least men will take when they know.

Now is the Time

Now is the time to pick out your new car. Next year's models are out now. You see what the field has to offer. And the best touring months are before you—the Indian Summer days. Get your new car and enjoy them.

If you buy a class car, this new HUDSON Six-40 is the car you'll want. The exclusive features which have won so much favor are bound to appeal to you. Your dealer will see that you get your car promptly if we have to ship by express.

Six-40
HUDSON
$1,550

Five New-Style Bodies:

7-Passenger Phaeton	$1,550
3-Passenger Roadster	$1,550
3-Passenger Cabriolet	$1,750
4-Passenger Coupe	$2,150
Luxurious Limousine	$2,550

All f. o. b. Detroit

Canadian Price: Phaeton or Roadster, $2,100 f. o. b. Detroit, Duty Paid.



HUDSON MOTOR CAR COMPANY, 8247 Jefferson Ave., Detroit, Mich.

(309)

WHITE MOTOR TRUCKS
Are the Nation's Choice

BOTH IN THE QUANTITY OF TRUCKS SOLD AND IN THE VALUE OF TRUCK SALES, WE ARE THE LARGEST MANUFACTURERS OF COMMERCIAL MOTOR VEHICLES IN AMERICA

Official Records of the Motor Truck Industry Verify This Statement

This Leadership of the Truck Industry is of the utmost importance, both to the many who already own White Trucks, and to the many others who will eventually purchase White Trucks.

TO THE OWNERS OF WHITE TRUCKS

THIS LEADERSHIP proves the correctness of your judgment in selecting your motor truck equipment.

It shows that you have chosen the same motor truck that the majority of truck users in America have selected.

In practically every case, this selection has been the result of a process of rigid experimentation and elimination, in which White Trucks have proved their superiority over all others.

This preference for White Trucks by the largest users of motor trucks as well as by the majority of motor truck users guarantees that your investment is protected by a successful, well established manufacturer, having a superior organization for rendering permanent and efficient service during the life-time of the trucks.



TO FUTURE OWNERS OF WHITE TRUCKS

THIS LEADERSHIP is conclusive proof that White Trucks must be superior to all others, because White Supremacy is not measured in numbers alone, but in value as well.

With so many makes of motor trucks on the market, all clamoring for recognition, indisputable supremacy can be gained only by superior merit.

Untruthful advertising, bargain prices, exaggerated claims and guarantees that cannot be fulfilled may make the first sale, but only superior merit can create the confidence which brings continuous repeat orders.

The record of continuous repeat orders whereby the foremost firms in America have acquired huge fleets of White Trucks, after experimenting with other makes, is a convincing reason why you should use White Trucks.

WHITE TRUCKS ARE MOST ECONOMICAL TO OWN

That White Trucks are slightly higher in price, makes White leadership in the truck industry even more complete. It is plain evidence that White construction is so superior that the higher first cost of a White Truck is economy in the long run—proof that White Trucks last longer and cost less to operate and maintain, making them the most economical trucks to own.

White Trucks are built in capacities of ¾, 1½, 3 and 5 tons

A SUITABLE SIZE FOR EVERY VARIETY OF SERVICE

THE WHITE COMPANY

CLEVELAND

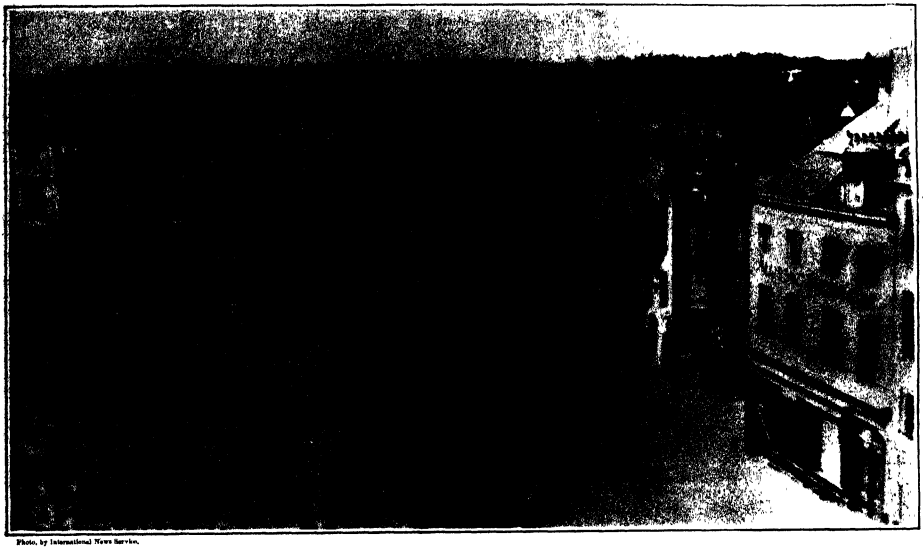
MANUFACTURERS OF GASOLINE MOTOR CARS, MOTOR TRUCKS AND TAXICABS

SEVENTIETH YEAR

SCIENTIFIC AMERICAN

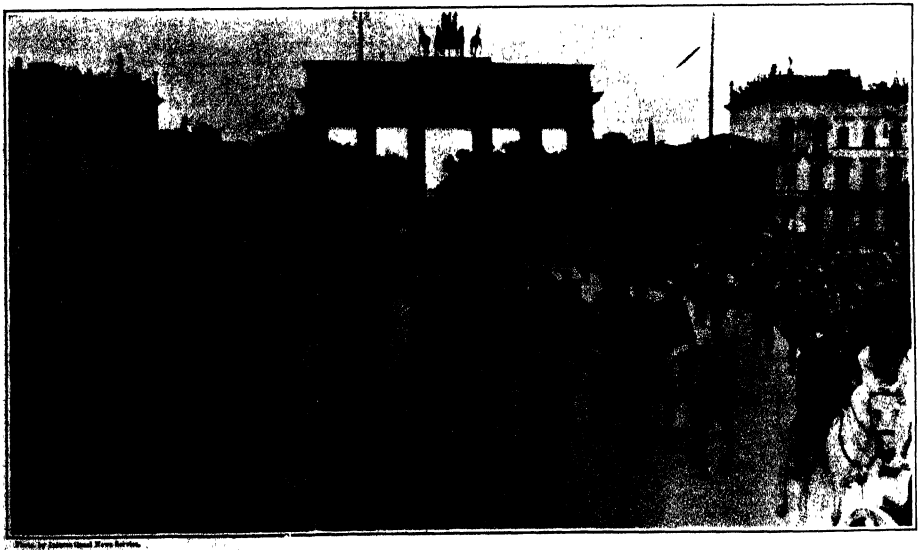
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Photo, by International News Service.

Louvain, after burning by the Germans.



Photo, by International News Service.

Captured French and Belgian guns hauled through the Unter den Linden, Berlin. On the Brandenburger Thor, seen in the background, is a bronze group brought back from Paris in 1871.

SCIENTIFIC AMERICAN

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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Frontiers in the Old World and the New

IF they were not so deeply engrossed, just now, in the work of mutual butchery, we would invite the warring nations of the continent of Europe to contemplate the following very significant facts:

First, that here, on the continent of America, the two greatest nations of the world have a common frontier, which extends, unbroken, for some four thousand miles.

Second, that throughout the whole vast reach of it there is not to be found, on either side, a single fortification, or any offensive or defensive military work of any kind whatsoever.

Third, that leading up to, crossing it, or running parallel with this frontier, there does not exist a single so-called military railway—every line of railway communication having been built with a single eye to the development of the natural resources of the two countries, and the mutual exchange of the products of peaceful industry.

Fourth, that in spite of the fact that this far-flung frontier was the eventual outcome of a fierce and bloody war, and that these two powerful nations have always been engaged in keen commercial rivalry, they have been content to leave their frontiers in this totally undefended condition, and have lived as perfectly amicable neighbors for the past one hundred years.

Except for the slight custom house delay at the border, there is absolutely nothing that suggests to the traveler, be he British or American, that he has crossed the line which marks his transit from his own to a foreign country.

But let the American take ship to Europe and commence his travels of leisure and curiosity. Everywhere he finds the frontier lines emphasized by enormous *forts*, which are themselves interconnected by chains of lesser redoubts and intrenchments, the whole work being insistent and obtrusive, and presenting a forbidding aspect of antagonism and defiance. Nowhere at the frontiers will he see the signs or hear the notes of welcome—everywhere his eye will catch the glint of the bayonet, or his ear will note the call of the bugle and the tramp of armed men.

Furthermore, a study of the railway map of Europe reveals the fact that other considerations than those of industry and commerce have determined the direction and the grouping of the railroads of central and western Europe. It is a fact, well understood, even outside of the war colleges of Europe, that military necessities have received the first consideration in the laying out of the railroad systems that have been built since the days of Bismarck and the formation of the German empire. When railroads radiate by the score to the frontier of a so-called friendly state, and when for all purposes of commerce they seem to end there, their meaning is plain. Taken together with the frowning *forts* which sit astride their most important junctions and meeting places, they constitute a permanent menace to the friendly state across the border, and they serve to smother, even at its very birth, any growth of that spirit of "peace on earth, good will toward men," of which the four thousand miles of undefended frontier on the Canadian border, and the one hundred years of unbroken peace between the United States and Great Britain, give such a noble and enduring expression.

That heavily fortified frontiers, backed up by a network of military railways, are a menace to a friendly neighboring state, and provocative of responsive military works, and that they produce an atmosphere of international suspicion and dislike, cannot be disputed. The turning of Germany into an armed camp, with its frontier fortifications as the outworks, may have been a policy pacific and purely defensive in intent; but its effect on the neighboring states has been the reverse of pacific.

We happen to have before us that illuminating work by Gen. Kouropatkin, the commander-in-chief of the Russian army in Manchuria, entitled "The Russian Army and the Japanese War." After a brief survey of the several wars of Russia and the gradual expansion of her empire, he writes: "Russia is in no need of any further increase of territory. This conclusion is in the highest degree important and satisfactory. At the same time, our military position does not now compare so favorably as formerly with that of our neighbors, principally owing to our lack of railways; and our western frontiers are exposed to great danger through the perfect state of preparation of Germany and Austria." Later in the same chapter, speaking of the growth of the Russian army keeping pace with the growth of population, he writes: "Our maximum in the Prussian war, 1756-62, was only 130,000 (troops). I am thankful to say we have lived at peace with our western neighbor for 150 years." After pointing out that Germany has a network of military railways leading to the Russian border, as against five Russian railways, he concludes: "Thus the chief duty of the War Department in the first years of the present century is the defense of our frontiers. Of these, our Austrian and German borders, being the most dangerous, should receive our particular attention."

This was written in 1900. Since that time Russia had planned and was constructing a system of defensive railroads to meet the emergency; and it was the determination of the German-Austrian alliance to strike before Russia could complete this great work, that formed one of the strongest motives for the precipitation by the Dual Alliance, in the present year, of the long-intended and carefully prepared for conflict.

There is a growing conviction that if the Teutonic attempt to establish that military dictatorship of Europe which was the ill-fated dream of Napoleon, results in failure, there will follow, if not the complete overthrow, at least the final subjugation and control of militarism. Of the many guarantees of this desirable result, we can think of none that would be more effective than the complete obliteration of those fortifications, modern in construction, but essentially medieval in conception, which menace and disfigure the frontier lines of the great European states.

Military Meteorology

AN American army officer—an instructor in the Army Service Schools at Fort Leavenworth—has written to the New York *Times* complaining that the press reports of the great conflict now in progress in Europe usually give no information as to weather conditions, "which have everything to do with military operations." He adds: "To the army officers among your subscribers the daily temperature, rainfall, direction and velocity of the wind, in all parts of the theater of war, are of an importance and interest surpassing columns of the material you give regarding skirmishes, reconnaissances, etc. These data are also extremely difficult to get after the occurrence, and your paper would become of permanent historical value if it gave these, if for no other reason."

It is true that the weather has occasionally cropped up in the war news, though so casually and modestly that its immense importance in shaping the course of events has been, apparently, quite lost sight of. Thus we gather that a dense fog greatly hastened the fall of Namur, by enabling the Germans to place their siege guns in an advantageous position without danger to themselves. The persistent drenching rains that fell during the long battle of the Aisne must have so impeded the movements of artillery, as well as other operations, as to modify materially the strategy of the commanders. Details on this subject are still lacking. The [illegible] heat of the early days of the war in Belgium is a matter of record. These bits of information have, however, quite exceptional; as a rule the weather has been altogether ignored by the correspondents.

Turn the pages of history and you will find that weather has always been a factor of prime importance in the conduct of war, playing a rôle analogous to, and co-ordinate with, that of topography, though, strange to say, military writers usually exaggerate the relative importance of the latter. It would be easy to compile a long list of battles in which the weather has actually been the *decisive* factor. Take the effects of rain alone: Heavy downpours and resulting floods led to the total destruction of the three Roman legions under Varus, in A.D. 9. Fifteen hundred years later persistent rains saved Vienna from capture and destruction by the Turks. In 1692 an English army was prevented by heavy rains from crossing the Meuse to relieve Namur, then besieged by the French, and the city fell. It would, however, be tedious to enumerate all the instances under this head.

The progress of military science has by no means rendered armies less susceptible to the effects of the elements. If the introduction of motor vehicles has facilitated the transportation of artillery, so has the use of heavy guns in the field increased, and muddy roads remain a serious obstacle. The deadliness of modern ordnance, as well as the use of searchlights and aeronautical fire-control, make it imperative to keep troops under cover to a far greater extent than was once the case; but a fog, or even heavy rain or snow, furnishes an ideal cover which does not entail immobility. Besides these and other physical effects of the weather upon military operations, the physiological and psychological effects of weather upon fighting men are still much the same as they were a thousand years ago.

It is evident that the modern commander must reckon with the weather in making his plans. If a body of troops is to be moved from one point to another, a heavy rain may make a difference of hours or days in the time required for this movement. An aerial reconnaissance, most desirable at a certain juncture, may be prevented by violent winds. A body of water, that today offers an impassable barrier to the enemy, may be to-morrow a practicable highway of ice. And so on.

A corollary to these considerations is the fact that it behooves military men to possess a knowledge of meteorology, and thus to be able to foresee changes in the weather, so that they may shape their strategy accordingly. It has, in fact, been recently suggested by an Austrian military expert that a competent meteorologist ought to be attached to the headquarters of every army. When the history of the present European conflict is written, it will be interesting to see what part scientific weather prediction has played therein. It is a safe guess that the Germans, at least, have already realized the possibilities of military meteorology and are utilizing this inchoate branch of applied science.

What Business Men Think of Our Trade Opportunity

WE have heard so much of the opportunity that beckons the American manufacturer and merchant in foreign markets, now that all Europe is embroiled in war, that it occurred to the Editors of the SCIENTIFIC AMERICAN to obtain from our representative business men their views on the possibility of expanding our export trade. Accordingly, we addressed a letter of inquiry to officers of those corporations whose activities had already made them acquainted with foreign trade and foreign business methods, and who were, therefore, in a position to give something like expert advice. The result is a collection of opinions which appears elsewhere in this issue.

After we had read these admirable presentations of competent authorities, we were impressed with the fact that our more prominent manufacturers regard our foreign opportunity not as a small boy contemplates an unguarded apple orchard, but as a great commercial problem which must be thoroughly studied before it can be attacked with success. With one or two exceptions, the letters are distinctly optimistic in tone. The writers, for the most part, realize that Germany and England have been successful in foreign markets because they have ascertained the needs of those whom they wish to serve, and because they have established adequate banking facilities.

Indeed, the whole problem narrows down to a study of foreign market requirements and to the establishment of a credit system acceptable to foreign consumers of American goods. Considered thus, the problem is one with which we ought to be able to cope successfully. The scientific study of our home market began not more than a decade ago, and the establishment of an elastic home credit system, which would aid our business men in financial crises, dates back only a few weeks. If the same systematic study is conducted in foreign markets, if the same consideration is shown for the banking requirements of foreigners as for Americans, there can be no reason why we should not gain a permanent foothold in markets which have hitherto been closed to us.

White Tuberculosis Costs the Nation.—It has been estimated that deaths from tuberculosis cost the nation half a billion dollars annually through the loss of wages and the value of production, and to conquer this enemy of the human race more than $20,000,000 is being expended. That the good work is progressing is shown by the fact that in twenty years the death rate from tuberculosis has been reduced from 245.4 to 164 per 100,000 of population. This success has been made possible by the discovery of the germ of tuberculosis by Dr. Robert Koch, thirty-two years ago, thereby opening the way for a scientific fight against this the most deadly disease the human race has ever had to contend with.

Protection for the Fighting Line of an Army

Fortifications and Their Relation to the Operations of Armies in the Field

By Lieutenant-Colonel Leon S. Roudiez, United States Army

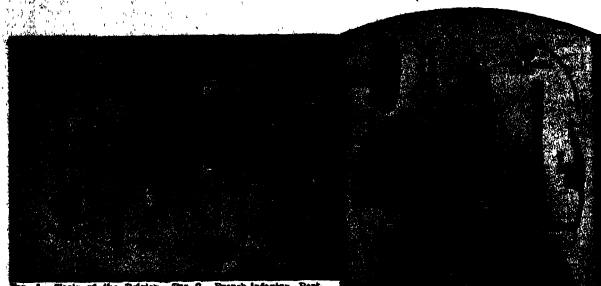


FIG. 1.—Tools of the Belgian infantry. Each infantry company carries an equipment consisting of 100 Linnemann shovels, 12 billhooks, 6 jointed or folding saws, 1 rose nipper, 1 three-cornered file, 24 canvas buckets, 12 field lanterns.

FIG. 2.—French infantry. Portable tools carried on the person of the soldier as a part of the field equipment. Each company receives 8 shovels, 4 pickaxes (double head), 4 picks (single head), 8 axes, 1 folding saw, 1 wire nippers.

FIG. 3.—United States infantry. To each company of 66 men: One 2-foot rule, 21 shovels with carriers, 1 60-foot and 1 5-foot steel tape, 2 hand axe and carriers, 7 pick-mattocks and carriers, and 9 wire cutters and carriers.

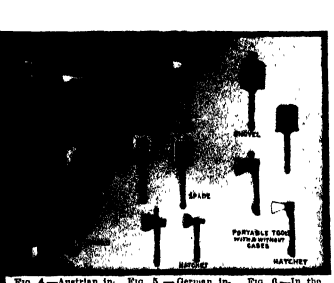


FIG. 4.—Austrian infantry. Each company carries 5 lanterns 1 handsaw, 1 spade for every two men, and 1 pickax for every fifteen men.

FIG. 5.—German infantry. The number of portable tools amounts to 115 to a company, as follows: 100 small spades, 10 pick hatchets, and 5 hatchets.

FIG. 6.—In the Dutch army each infantry company carries rifles, ammunition, 16 axes and 100 small shovels.

THE principal object of this article is to present in as simple a form as possible—free from technicalities—a general description of the various types of fortifications in use in modern warfare.

Offensive operations demand a high degree of mobility. This naturally suggests a careful consideration of the relation existing between fortifications and the mobility of an army in the field. The writer hopes that with the assistance of the accompanying illustrations, the non-military reader, for whom this is especially intended, may obtain a clearer idea than he had before of the uses and means of providing artificial cover and protection for the fighting lines of an army.

Fortifications may be divided into two classes, permanent fortifications and field fortifications. No attempt will be made to describe the former class any further than is absolutely necessary to point out the difference between that class and the one designated as "Field Fortifications," which is the real subject on this paper.

The Object of Fortifications.

Permanent fortifications consist of defensive works constructed by a nation to secure permanent possession of strategical positions of importance within the territory under its control. These would generally include national capitals, great commercial and railway centers, harbors, important bridges and mountain passes, great concentration camps and depots of supplies.

The decision as to whether or not a city shall be fortified depends first on its location, second, on its importance.

Many European cities are really large forts surrounded by one or more lines of smaller detached forts located at strategic points some distance, varying from 5 to 15 miles, from the walls of the city. Paris, Belfort, Strassburg are some of the many examples of this

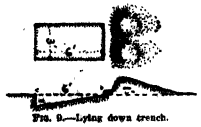


FIG. 9.—Lying down trench.

type. Other cities, like Liège, are surrounded by one or more lines of detached forts, while the city itself is practically open or unfortified.

Earth embankments, stone and concrete walls and steel shields and turrets enter into the construction of the modern permanent fortifications. They are built in time of peace, armed with the latest type of heavy guns, and are supposed to embody the best thoughts of the strategic and of the military engineer.

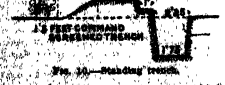


FIG. 10.—Standing trench.

The Big Gun is the Death Knell of Permanent Fortifications.

Our text books tell us that "a position protected by permanent fortifications and properly garrisoned should yield only after a protracted siege." This was quite true yesterday, but to-day the gunmaker is turning out a new portable howitzer of wonderful power which,

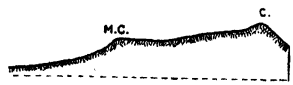


FIG. 7.—Profile of hill. Point M.C is the "Military Crest," although it is not the highest point or crest of the hill.

if we can trust the contents of recent war bulletins, is sounding the death knell of the permanent fortifications of modern times.

Long before the advent of the 11-inch howitzer a number of military writers expressed strong doubts of



FIG. 8.—The ground covered by a shrapnel is elliptical in form and at the effective ranges does not exceed 200 yards in depth by 28 in width. Shrapnel is the most important projectile. The case is of drawn steel with solid base. The mouth of the case has an aluminium head screwed in and tapped to take a combination time and percussion fuse. The case contains 363 balls, each 0.49 inch in diameter. The bursting charge consists of 2¾ ounces of loose black powder; it is placed in the base, and covered by a steel diaphragm. The fuse is timed so that the case will burst just in front and above the trenches or line of troops.

the value of permanent fortifications as applied to large cities and great camps. They argued, and cited many instances in support, that a fortified city does not prevent an invasion of the national territory by a strong and numerous enemy who can well afford to detach a force sufficient to invest the fortified place and immobilise its defenders—compelling them to capitulate within a comparatively short time—while he proceeds with the main operations with the bulk of his troops.

An army in the field may meet with daily reverses, but, if skilfully handled, it can avoid disaster, and even if brushed aside by a much stronger force it can retain its mobility and thus continue to annoy the enemy and endanger his lines of communication. It continues to be a factor in the game. It cannot be ignored.

An army operating within its national territory may even cut loose from its fortified base of supplies, and falling back on its own country, procure its supplies from local sources, until a new base can be established. By keeping constantly in touch with the enemy this mobile army may have the opportunity of inflicting serious damage, if not defeat, on the invaders.

The Temptation Offered by Permanent Fortifications.

No such opportunities are opened to the commander who, in the face of reverses, allows himself to be tempted by the fancied security offered by permanent fortifications. He may deceive himself into believing that he is simply taking refuge within the fortifications for a few days in order to give his men a little much-needed rest or to replenish his supply of food or ammunition, and that he will soon again take the field better prepared to fight than ever before. But the chances are against him. When he thinks he is ready to take the field, he finds that the enemy has invested the place. If he is to get out, he must practically cut his way out. This would mean that most, if not all, his baggage and supply trains would probably be lost, or have to be left behind. He would then be a great deal worse off than before. As a matter of fact, when an army takes refuge behind permanent fortifications it seldom comes out again except as "prisoners of war." The moral effect of capitulation, even after a "heroic siege," is almost as serious as the loss of men and material.

It is not the intention to condemn all permanent fortifications. There are many cases where, in certain locations, fortifications will be found invaluable in preventing or delaying an invasion, but these should be of a type that clearly illustrate the principle on which the value of fortification is based, to wit: Greatly to increase the fighting power of troops occupying the position, by increasing the effect of the fire action of the troops protected by the fortification and to diminish the effect of the fire action of the assailant and limit his mobility, thus enabling a comparatively small gar-

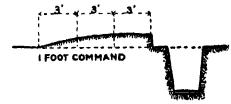


FIG. 11.—Standing trench without screen, but with low parapet for better concealment.

rison to resist the attacks of a greatly superior force successfully, and prevent its advance into the guarded territory.

Offensive Operations More Likely to be Successful.

It has been generally conceded that real success in war results only from offensive operations.

It is true that in order to gain time to complete the



FIG. 12.—Standing trench, a little wider and with 6 inches more "command," i. e., the soldier stands so that his eyes can see over a parapet 18 inches higher than the natural level of the ground, instead of 12 inches, as in Fig. 11.

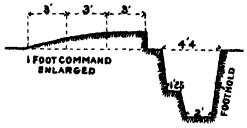


FIG. 13.—Same as Fig. 12, but enlarged to facilitate communication in the trench, behind the line of men firing over the parapet. The foothold is to assist the men in getting out of the trench

mobilization of its troops, or for other reasons, a nation in danger of invasion by a more powerful or better prepared neighbor may be compelled to assume a defensive attitude. Its highly disciplined and efficient armies, skillfully handled, may be able to inflict tremendous losses on the invader by repeatedly compelling him to attack and carry strong defensive positions, previously prepared, in order to continue his advance into the defender's territory. The defenders, by a succession

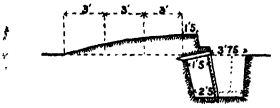


FIG. 14.—Same as Fig. 13, but with splinter proof cover. This is for protection against shrapnel bullets.

of well timed and orderly retreats to selected positions in the rear, may succeed in drawing their more aggressive opponent into a position where all the advantages, strategic and tactical, will then be on the side of the defenders. All this, however, will result in little or no advantage to the defenders unless they are prepared

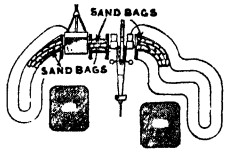
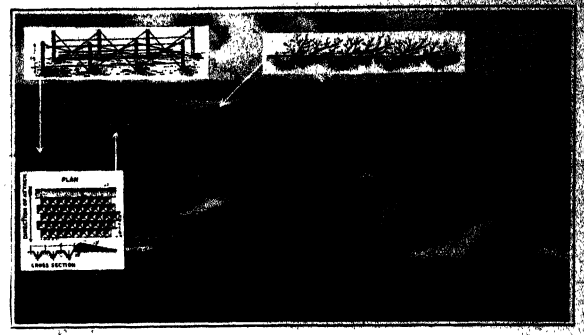


FIG. 16.—Hasty intrenchments for field artillery: protection against rifle fire and shrapnel.

and willing promptly to assume the offensive at the psychological moment, and thus turn the tables on the weakened enemy and drive him out of the country.

A protracted defensive is a dangerous game. Recent events show that a skillful commander can play it successfully against perhaps the best armies the world has ever seen. We are not yet in position to count the costs or to predict the ultimate results. At date of writing the counter offensive is meeting with success. This is in accord with the rules of the game.



The small inserts indicate the more usual types of obstacles employed in the defense of redoubts. The arrows indicate where they are to be found in the main picture.

Fig. 15.—Redoubt, showing types of field casements and bomb-proofs.

To elucidate: In connection with the disadvantages of a strictly defensive campaign, let us assume that the armies of a strong nation have invaded the territory of one of its neighbors. The latter, for reasons of its own, assumes a defensive attitude, and by a succession of skillfully-managed retreats within its own territory, during which it has been able to inflict severe losses on the enemy, it succeeds in drawing the invaders far from their base, and, as a result of the losses inflicted and of the dangers to which their lines of communication are exposed, the latter reach a point where they must halt for a while to recuperate or await reinforcements. Let us suppose that the defenders are then either unable or unwilling to assume the offensive. Military operations with the exception of unimportant clashes between advance guards and reconnoitering patrols, will practically come to a standstill for the time being.

Both combatants might be willing to make peace under certain conditions, but neither is in position to suggest it. The invaders cannot propose it because it would be taken as an indication that, while successful up to date, they fear for the future, and would be willing to quit while they have the advantage. As for the defenders, a proposition from them would be equal to acknowledging that they are hopelessly beaten. Therefore both await developments.

This, however, is the opportunity of the peacemakers especially the "peace at all cost" advocates. Considering the strong public sentiment against war in any form existing throughout the world to-day, several allied nations might decline to consider offers of mediation from neutral powers on the ground that the time had not yet arrived for such action; but no one nation would risk antagonizing public opinion by refusing to

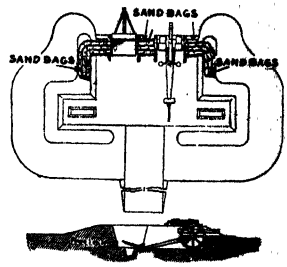


FIG. 17.—Deliberate intrenchments for field artillery when depression is necessary for concealment.

accept the good offices of neutral, friendly nations under the circumstances outlined in the foregoing situation. Therefore, we may assume that in response to friendly advances and representations, both belligerents agree to an armistice for the purpose of discussing peace preliminaries.

The military situation would then be about as follows: The invaders have not crushed the defenders, they have not captured any of their armies, or decisively defeated them, or caused any of their fortresses with their garrison to capitulate; neither have they captured their capital nor seriously interfered with their national government. But they have invaded the defender's territory and are occupying a more or less extensive portion of it in force, and are preparing to resume the offensive. The defenders on their side have retreated, it is true, but they have not been decisively defeated at any point. Their defensive operations have compelled the invaders entirely to change their original plan of campaign and to abandon strategic operations



Fig. 18.—Street barricades, showing loopholes cut through walls.

Note also passageway cut through walls connecting the houses on each side. The deadly house-to-house fighting mentioned in battle reports, takes place along the line of these passages. The insert shows the general arrangement of such passages clearly.

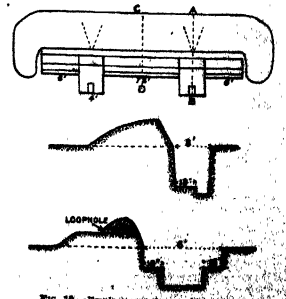


FIG. 19.—Emplacement for machine gun.

...ing an unbroken record of great importance in bringing the war over to a successful close, and yet the defenders, as a rule, continue to take the offensive at this time, are subject to a great moral and physical disadvantage. They will be greatly handicapped when the question of peace terms is brought up for discussion. It must be borne in mind that the invaders are in position practically to dictate the terms on which peace shall finally be concluded.

Hence the axiom in war: Real success results only from offensive operations.

Field Fortifications.

Field fortifications deal with such works of a temporary character as may be constructed in time of war by troops in the field, for a specific purpose, with the tools usually carried by the troops as part of their equipment, and with the material found in the locality. It may sometimes happen that the necessity for the field works under preparation may pass before the job is completed.

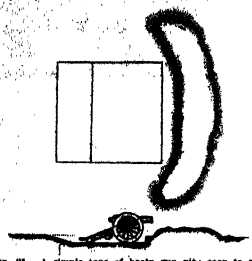


FIG. 21.—A simple type of hasty gun pit; easy to construct; gives practically as much protection as Fig. 17 (without the splinter-proof cover), and is very suitable in connection with shelter trenches.

Field fortifications may be divided into hasty intrenchments used by troops upon the battlefield to increase or prolong their powers; and deliberate intrenchments, not in line of battle, such as may be required to protect lines of communications and supply, lines of retreat or to strengthen a position in readiness.

It often happens that a line of lying down trenches may develop into a line of deep trenches with splinter proofs, saps, and communication trenches for the supports as well as gun emplacements for the artillery; thus taking on all the characteristics of a position in readiness.



FIG. 20.—Section of parapet in loose soil

Redoubts (see Fig. 15) are the most complicated types of field fortifications, and in some instances have compelled an assailant to resort to a siege to secure the capture of the position. This, however, was before the days of the 11-inch howitzer.

When conditions and time permit and the materials and men are plentiful, a great deal of care may be devoted to the details of construction so as to produce finished work, perfect in efficiency as well as in appearance. To this end the trace and profile are carefully laid by actual measurements, etc., but on the field of battle where quick results are required, where men are nearly exhausted by long marches and strenuous fighting, etc., even "positions in readiness" are prepared without much regard to beauty of design or absolute correctness of details.

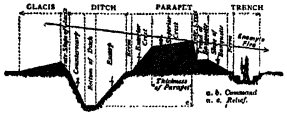


FIG. 20a. Section of intrenchment made in stiff soil. The legends designate in military terms the various portions of such an intrenchment.

How Intrenchments Are Made.

Intrenchments are used both on the offensive and on the defensive whenever circumstances permit. The cover provided by intrenchments is a defensive weapon of which full use should be made by commanders of all grades on their own initiative. The intrenching tools provided for infantry (Figs. 1 to 6) form a part of the combat equipment of that arm, and are invariably carried into action. Additional axes, picks, and shovels of the regular size are carried in the battalion ammunition wagon and in the regimental engineer wagon.

The primary object of intrenchments on the defensive is to enable a comparatively small part of a command to hold an extended front in order that the remainder

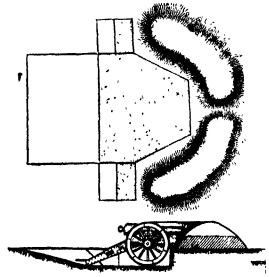


FIG. 22.—Hasty gun pit; protection in front and on the sides. Seven men with full size picks and shovels, will construct this in one hour

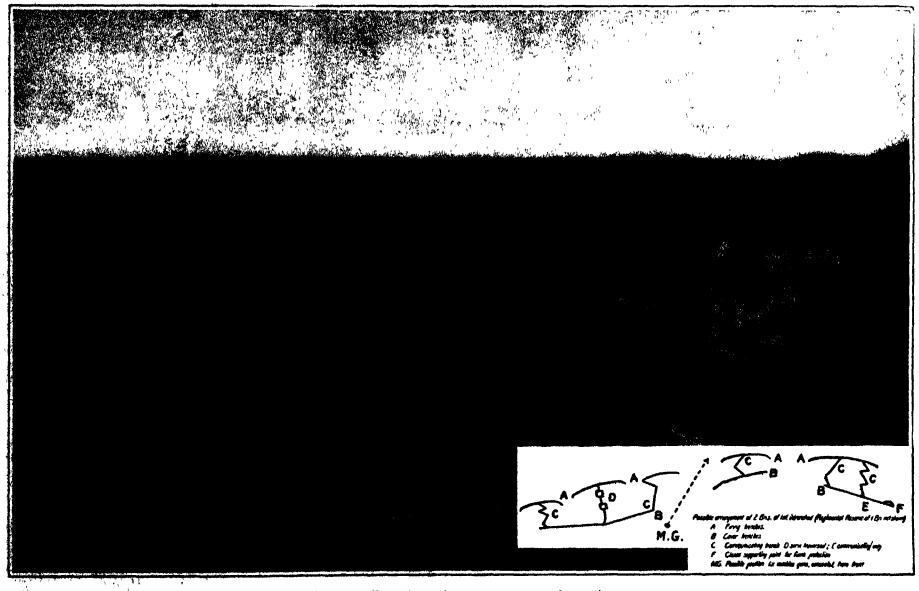


FIG. 25.—The line or lines of trenches may or may not be continuous.

The communicating trenches connecting the firing with the cover trenches are so constructed that they cannot be swept by fire for their whole length.

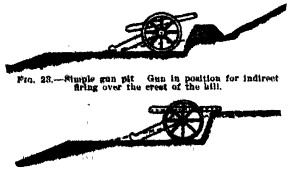


FIG. 23.—Simple gun pit. Gun in position for indirect firing over the crest of the hill.

FIG. 24.—Simple gun pit on crest of a hill. Gun in position for direct firing

The deliberate intrenchments, not in line of battle, such as may be required to protect lines of communications and supply, lines of retreat or to strengthen a position in readiness.

It often happens that a line of lying down trenches may develop into a line of deep trenches with splinter proofs, saps, and communication trenches for the supports as well as gun emplacements for the artillery; thus taking on all the characteristics of a position in readiness.

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may be available for offensive operations. It is, therefore, essential that higher commanders realize the full possibilities of field intrenchments, and that subordinate commanders be prepared to construct and mend them in the shortest possible time.

We are told that the Japanese soldier is an indefatigable digger. During the Russo-Japanese war, the little men of Nippon were either marching, fighting, or digging. It is well to consider, in this connection, the fact that racial characteristics vary greatly, and what may be expected of the soldiers of one race may prove impracticable for those of another race. The successful commander will know when the endurance of his men is near the breaking point, and he will stop

with a fair margin of safety between himself and possible disaster.

The following tables, taken from the field service regulations of the United States Army, will be found of interest:

Range.	Rifle	Field artillery	Heavy artillery.
	Yards.	Yards	Yards
Distant	Over 2,000	Over 4,500	Over 6,500
Long	2,000 to 1,200	4,500 to 3,500	6,000 to 4,000
Effective	1,200 to 600	3,500 to 2,500	4,000 to 2,500
Close	Under 600	Under 2,500	Under 2,500

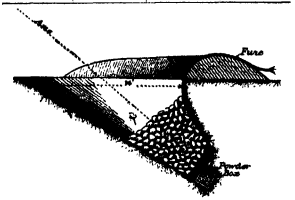


FIG. 27.—Fougasse, a type of land mine of doubtful value

PENETRATION OF RIFLE BULLET

Material	Inches — 200 yards	600 yards
Commercial steel	0 30	0 20
One-inch broken stone, gravel	4 80	4 28
Hard coal between 1-inch boards	9 00	7 00
Brick masonry, cement[1]	2 20	1 10
Brick masonry, lime[1]	2 40	1 14
Sand, dry[2]	18 18	11 96
Concrete, port. 1-3-5	4 00	1 86
Oak	26 46	12 46
Sand, wet	30 00	13 00
Pine	25 72	13 00
Earth, loam	30 00	16 12
Grease clay	60 00	32 00

[1] For single shot.
[2] In sacks, about one-half these figures.

Effect of Artillery Fire.

Up to 3,000 yards, the 3-inch field gun, using high explosive shell, is effective against ordinary types of overhead cover for field trenches, brick buildings, and stone walls 2 feet thick. It is ineffective against earthen parapets.

The heavier types of field guns and howitzers are effective against all kinds of field works, and protection against this kind of fire must be secured by concealment.

AVERAGE RESULTS OF ONE MAN HOUR LABOR.

Excavation—
In easy Soil—
First hour ..... cubic feet[1] 30
Second hour ..... " " 25
Third hour ..... " " 15
Thereafter continuous work ..... " " 10
In hard soil, about half the above.
In loose earth, 60 cubic feet.
Filling sand bags, 20 bags (0.5 cubic foot each).
Revetment construction (materials and tools on hand):
Rough brush wood or plank..sq. ft. per man hour 40
Brushwood hurdles, rough—
Making ..... " " " " " 15
Placing ..... " " " " " 30
Sand bags—
Filling ..... " " " " " 10
Placing ..... " " " " " 20
Sod—
Obtaining sod for ..... " " " " " 7
Placing ..... " " " " " 10
Obstacle construction (material and tools on hand)—
Abattis, wired (1 strong row) ..... linear feet 1.5

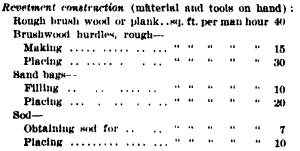


FIG. 28.—Types of field casemates and bomb-proofs

Wire entanglement—
High ..... square feet 27
Low ..... " " 90

[1] By working in two reliefs above figures can be increased by one third.

Clearing[2]—
Thickets up to 1.5 inch diameter ... square yards 25
Light clearing of soft woods, trees to 12 inches in diameter ..... " " 25
Medium clearing ..... " " 15

The Principle Regulating Use of Intrenchments.

The principle that regulates the use of intrenchments by troops on the defensive and by troops on the offensive is expressed in the following words taken from the Field Service Regulations of the Army of the United States, page 72:

"On the defensive the artificial strengthening of the position taken up is limited only by the time and the facilities available. On the offensive, intrenchments are used on all lines that are to be held for any length of time. Troops advancing to the attack must understand that the best protection against losses is afforded by an uninterrupted and vigorous advance toward the enemy's position, and by the use of such natural cover as the ground offers. In the attack intrenchments will be used only when further advance is for some time impossible, and to hold ground already gained."

It is quite evident that as a general rule troops on the offensive will be restricted to the use of the types of trenches shown in Figs. 9, 10, 11, and 12.

It may happen that when fighting extends along a front of many miles, some troops may be more successful than others, and thus gain ground much in advance of the general line. This, if permitted to proceed to any great distance, would have the tendency to leave gaps in the line, or weak spots on the flanks of the



Fig. 26.—Loopholes made of sandbags. Note the use of barricades.

successful troops which would prove most dangerous to the general line, as well as to the advanced troops themselves, if confronted by a tenacious and aggressive opponent. Furthermore, the success of the campaign does not depend on isolated advantages of individual units, but on the successful advance of the entire line, the several units (divisions, army corps, or field armies) supporting each other in the forward movement, all under the general supervision of the commander-in-chief. Therefore, it may be necessary to hold back the more advanced portion of the line until the other units are able to come up to it. To enable them to hold what they have won the advanced troops will intrench. The type of trench selected would probably be one of those shown in Fig. 10 or Fig. 11, to be enlarged later, if time permits, into that shown in Fig. 13.

If time will permit, the position may be further strengthened by digging cover trenches for the supports and reserves, building bomb-proof shelter for the men in the trenches, Figs. 14 and 15, and intrenchments for machine guns, Fig. 19, and field artillery, Figs. 16 and 17.

The line or lines of trenches are not necessarily continuous. They usually form irregular groups of intrenchments distributed along the front of the position, the firing trenches facing the enemy's lines or the avenues of approach (see Fig. 25).

It would be well to note at this point that this advanced part of the line, while still a factor in the general offensive movement, has now assumed a defensive attitude "seeking a favorable decision," which means

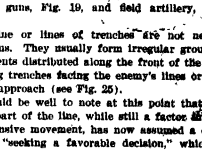


FIG. 29.—Loopholes made of sand bags.

that it is simply waiting for the opportunity to resume the offensive, and that is the only form of defense that can secure positive results.

[2] Removal of cuttings in both cases involves an equal amount of labor.

Time is a great factor in connection with hasty works, especially hasty intrenchments.

Different Trenches and When They are Used.

The simplest form is generally used by the advance under fire. The advancing line may have outlined points

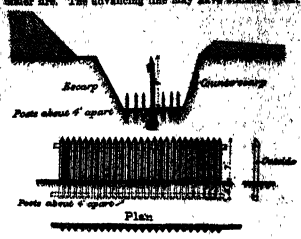


FIG. 30.—Palisades in dry ditch in front of parapet.

losses, or the ammunition may be running low. At all events, it finds itself unable to gain ground to the front. To retreat would be fatal. It must remain where it is—some of the men find natural cover, but many must provide artificial protection from the enemy's rifle fire. The men are lying down as flat as they can. To arise, even to a kneeling position means death or a disabling wound. The necessity for cover under these circumstances caused men to devise the lying down trench, sometimes called the skirmishers' trench, Fig. 9. It gives cover from rifle fire to a man lying down, but is absolutely no protection from shrapnel bullets. The height of the parapet should not exceed one foot. The trench itself is about two and a half feet wide and about six feet long. It can be constructed by one man in soft ground, using the portable intrenching tools, in about 20 minutes. Under fire, as outlined in the foregoing, the man being compelled to remain in the prone position, he can mask himself from view in from 10 to 15 minutes and complete the trench in 40 to 45 minutes. In this position, and in view of the small number of portable intrenching tools carried by the company, the man would be obliged to use his knife bayonet to loosen the earth and the cover of his meat can to shovel it in front of him. One of the methods of working suggested by the text books, is to dig a trench 18 inches wide as far back as the knees; roll into it and dig 12 inches wide along side of it and down to the feet; then roll into the second cut and extend the first one back to the feet. This trench was seldom used in the Manchurian war. The best that can be said for it is that men can obtain slight cover under a hot fire with a minimum of casualties because it involves less digging, and they are partially protected from the very beginning of the work.

The kneeling trench, not illustrated, is the simplest form of trench for troops on the main line of resistance, but is fast going out of favor. It does not afford sufficient protection, and it is too visible.

Normally, the first objective will be the simplest form of the standing trench, Fig. 10. A good standing trench can be constructed in from one to one and a half hours by using regular sized tools. This trench may be enlarged and improved to obtain results shown in Figs. 11, 12, 13, and 14.

How Improved Fire-arms Have Affected Trench Digging.

Military experts have greatly modified their views in the matter of profiles of infantry trenches. These changes are due to the improvements made in firearms of all caliber, both in range and penetration, to the development of indirect and high angle fire of light and heavy field artillery, and to the possibilities of aeronautics in connections with military scouting.

A great deal more weight has been given to concealment from view. The greater depression angle of lines of vision made possible by aeroplane observation should also receive consideration.

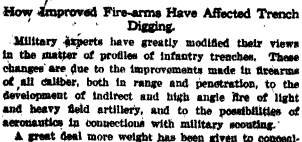


FIG. 31.—Felled tree obstacle. Branches pointing outward.

The trench that shows the least alteration in the appearance of the surface of the ground will be found to be the most satisfactory. For this reason, instead of making the exterior slope as steep as the material of

which in contests will stand (Fig. 20) it will be better to make it as flat as the supply of material and the labor of placing it will permit, and the superior and interior slopes should either be merged (Figs. 10, 11, and 12), or make a small angle with each other, and in the latter case should be joined by a curve." (Part V. S. F. M., U. S. A.)

Bullet-proof roofs and overhead cover, no matter how slight, are considered essential.

So great is the necessity of concealment as shown in recent war experiences, that many experts are beginning to question the value of great redoubts and similar types of field fortifications, as these cannot be used in positions exposed to artillery fire unless they can be so constructed and disguised that they cannot be recognized as such from the enemy's artillery positions. When we consider the possibility of discovery by the military observer scouting in his aeroplane several thousand feet above the position, with his ability to indicate by signals while in the air or by means of a position sketch after he returns to his lines, the exact location of the redoubt and supporting batteries, we must realize that imposing works with prominent parapets and gun emplacements as illustrated in the text books, are things of the past. In ordinary rolling country the conditions of defense will be fully met by the infantry standing trench with communication and cover trenches for the supports, reserves and ammunition. These, if located on carefully selected points will answer all the requirements of redoubts without resorting to the use of closed works.

The improvements made in field artillery fire make it possible for batteries to do effective work without much exposure or danger from rifle fire.

The simplest form of protection, Figs. 21, 22, 23, and 24, will probably answer all the requirements.

Concealed Men Firing at Concealed Targets.

In the old days, the gunner had to see his target. He stood at the elevating wheel, looking through the rear sight and indicating the horizontal direction of the piece to the man who stood at the trail, ready to move it to the right or left as directed by the gun corporal; the latter raised or lowered the breech until the front sight rested on the target; the signal was given and the gun fired. Now, however, things are done differently. The gunners need not see the target at all. The battery commander with his assistants stationed on a flank of the line of guns, in prolongation of this line or directly in rear of and above it, watches the effect of the firing and gives all the directions as to the aiming point—which is *not* the target—and the range elevation, kind of fire, type of projectile, etc., to be used. The battery commander gets most of his data by means of a wonderful instrument called the battery commander's telescope. His station is connected with each gun by telephone or busser.

The aiming point (not the target) must be selected with care, "something tall and slender such as a flag staff or church steeple is best. It should preferably be a mile or more distant" (Notes on F. A.).

The battery commander's problem is "to determine the deflection that must be set off on the sight, so that when the sight is brought to bear upon the aiming point the gun shall be trained upon the target" (Notes on F. A.). This sounds very complicated, but the trained artillerist gets wonderful results in an astonishingly short time—just a few minutes from the time the position has been selected.

In addition to the trenches, including parapets, ditches, abattis, trous de loup, wire entanglements, etc., shown in Fig. 15 as means of defense, we must not forget that in thickly populated countries, armies often find it necessary to hold small towns and villages, as these often form part of the line of defense, or are included in it on account of their location in proximity thereto. (Figs. 18 and 26.)

The Use of Mines.

Land mines are usually formed by excavation from the surface and are designed to be exploded at the moment the enemy is over them. Such mines are usually employed in front of defensive positions, prepared in advance, in connection with visible obstacles, such as abattis, wire entanglements, etc. The charge is placed near the surface, just deep enough to avoid artillery projectiles. The mines may be placed in several rows, and their positions concealed as completely as possible.

If everything works well and the enemy will congregate on the mined ground these mines and the fougasses (Fig. 27) should do great execution. As a matter of fact, past experience shows that the results do not warrant the time and labor expended in their preparation. In addition to this, the craters formed by the explosions make an excellent line of trenches for the attackers

In conclusion we may say that many of the simpler forms of field fortifications described in this article and in text books will continue to be used, more or less extensively, by troops on the defensive and to a lesser degree by troops on the offensive.

That greater weight should be given to concealment of the line of works. That in the preparation of the trenches provisions should be made to enable the troops manning them to leave them quickly to take part in a counter attack on the assailant or to take up a new position in rear. Troops that have been fighting for days or weeks with varying success are apt, when they find themselves behind strong intrenchments that have cost them additional efforts, to hesitate about leaving them; they feel secure and know that they need rest. Their mobility is seriously affected if not paralyzed. Commanders of troops must realize the advantages as well as the disadvantages of intrenchments, bearing in mind that real success in war depends on offensive operations, and that troops on the offensive should be taught and encouraged to depend for their protection on the intelligent use of such natural cover as the ground over which they are advancing may offer; on the accuracy and intensity of their rifle fire; and, above all, on their determination to get close to the enemy as soon as possible and drive him out of his position at the point of the bayonet.

Strategic Moves of the War

Letter from the Military Expert of the SCIENTIFIC AMERICAN, September 25th, 1914

The French Campaign.

THE week has seen a slow development of the great battle of the Aisne. Reinforcements have been rushed to the German right to enable Generals von Kluck and von Buelow to resist the French and British attacks. All garrison detachments that could be spared have been united with reserve corps to form a new army under General von Boehm to protect the German right flank.

The German line runs from near Lille, south to Soissons, then east to Etain, 20 miles northeast of Verdun, and then southeast, near the French border, to the Vosges Mountains, and on *via* Mulhausen to the Swiss border. The Allies are trying to break through this line near St. Quentin in the north and also in the hills north of Verdun. The Germans are trying the same strategy under more unfavorable conditions just east of Rheims, and also north of Toul.

Both of the opposing armies are trying the same strategy; the side that succeeds first will force the other back. The danger in having the line pierced lies in the breaking up of the co-ordination of the armies of the defense. When such immense forces are engaged every step of the operations requires co-operation. If the plan is broken up it is difficult to gather up the loose ends to fit the new conditions. The successful assailant has better control of his forces, and can readily turn them where they will gain the greatest results. By concentrating first on one part and later on the other of the divided enemy he can crush the opposing armies in detail. The German attacks north of Toul have in front of them the formidable obstacle of the French line of forts along the hills on the east side of the Meuse. The French advance into the hills of the Ardennes is directed against the German fifth army, under the Prussian Crown Prince, well situated for ready reinforcement *via* Luxemburg. The German counter attacks east of Rheims, from a part of their line where reinforcements and supply are difficult on account of lack of railroads, in will require difficult and costly assaults to let any of these armies to succeed.

The importance of the Allies' flanking move against St. Quentin lies in its application to the line of communications through the Belgian and French railways. Just as the position of the army will change a little, so will the position of the supply lines of an army destroy its strength. With the enormous numbers now in the field any interruption of supply will cause starvation at the front.

So important is the maintenance of the lines of communication that their capture would be vital. These are the reasons that lead the Allies to go slow all along the line while pushing the flanking movement. If the latter succeeds the Allies will force the Germans out of their present position without the loss of life consequent upon frontal attacks.

The remarkable thing about the frontal assaults that have been so common in this war is not the great loss of life, but the fact that any men survive to reach their goal. When we remember how the Indians from Fort Du Quesne (Pittsburgh) from their vantage points behind trees mowed down the columns of British under Braddock when they advanced in the open, it seems wonderful that any troops can hope to live through an assault against men behind the shelter of trenches and parapets.

The explanation lies in the accuracy of artillery shrapnel fire. No assault can be made until the assailants have gained superiority in artillery. Their artillery then sweeps the trenches of the defense with a hail of shrapnel that keeps the defenders under cover. The assaulting infantry take advantage of this protection to work up close to the enemy. The trajectory of the shrapnel is so definite that the artillery can keep up fire until the infantry of their side are within 400 yards of the trenches. Even then the artillery fire is not stopped entirely, but is directed beyond the trenches to catch any reinforcements that the enemy may be sending up from his rear.

The artillery thus supports the infantry advance until the line is within a few short rushes of the enemy's position. At the same time the shelling of the trenches tends to shake the *morale* of the defenders, weakening their resistance to the assault.

The Russian Campaign.

The developments of the Russian campaign have progressed far enough to show the strategy of the earlier stages. As is well known, Germany gave every effort to the campaign in France, only two active army corps were left in the northern part of Russia in Posen.

The Austrian army, which had been mobilizing for eight days when Germany declared war on Russia, was counted on to join the German Landwehr armies to delay the Russian advance. To this end Austria concentrated the bulk of her forces in Galicia and sent them north on both sides of the Vistula to take in flank the expected Russian advance through Poland.

The expected delay in Russian concentration led Austria to send two corps to the Rhine to hasten the decision in the western theater. These corps were moved back east after the strength of the Russian Galician invasion was developed, but their support was lost from the operations up to Lemberg.

A further factor in upsetting the Austrian plan was the strong resistance put up by Servia. To match the four Servian corps Austria had to keep four first line corps in the south. As the Servian campaign developed Austria had to send large numbers of reserves to this theater to offset the effects of the Servian victory at Sabac. The dangers from a Servian invasion are so great that Austria has to make sure of her southern boundary even at the expense of taking chances in the north.

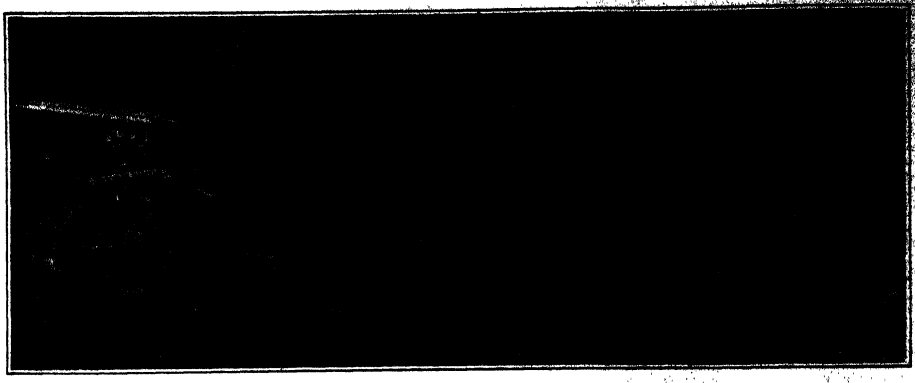
The Austrian army in Eastern Galicia was so outnumbered by the armies of the Russian invasion that it was forced back rapidly to the Grodek lines west of Lemberg. The strategic invasion of Poland was also pressed back to the Krasnik-Tomaszow line. The two armies occupied a quadrant from the Vistula River to the Carpathian Mountains, held by four Austrian armies.

The Russians advanced against them in four armies, two of which concentrated on the Austrian center at Tomaszow The Russians broke through after three days stubborn fighting and forced the Austrians to fall back to the line of the San and Vistula rivers.

In this strong position the Austrians might have been expected to make a stand, but they were threatened by a new danger. A strong Russian force advancing on the west bank of the Vistula was attempting to get beyond the west flank of the Austrian line. A success in this move would give the Russians a central position between the Austrian Galician armies and the German armies in Silesia. With these deprived of mutual support the Russians could turn the bulk of their forces first on one and then on the other, crushing them in turn.

For this reason rather than any decisive defeat the Austrians are forced to move rapidly to the west in order to maintain concerted action with their German allies.

The Russian invasion of East Prussia now appears to have been intended as a demonstration. By striking the first blow here, Russia led Germany to rush her reserves to the northwest to reinforce her two active corps and the local reserves. By this move the Germans regained superiority in numbers and forced the Russians back to the Niemen River, but the Austrians were left practically unsupported to receive the full force of the main Russian army.



Gun carriage of German 11-inch field mortar, hauled by motor truck.

Mobile Siege Guns in the Present War

The Powerful Mortars Which Would Have Quickly Reduced the Paris Fortifications

ONE of the most striking developments brought to light, or at least brought to public attention, by the present war, is the enormous size and power of the mobile artillery with which the contending armies, and particularly those of Germany, are equipped. The most formidable of these weapons, the one which has attracted most attention in the present war, is the enormous 11-inch siege mortar, which, in the accompanying illustration, is shown in transit, and is depicted in action on the colored cover inclosing this issue.

The 11-inch mortar was developed and constructed in large numbers at the famous ordnance works of Krupp at Essen. In respect of size, weight and destructive power this piece marks the climax of a rapid development of heavy ordnance capable of being transported with an army and quickly emplaced for the reduction of permanent fortifications, such as those which were reduced at Liege and Namur. Up to the time of the Russo-Japanese War, a distinction was made between heavy and light siege units. The latter were mounted upon wheeled carriages, and they were capable of being moved with an army on the march. The heavier siege units, say of from 9-inch to 11-inch caliber, required special means for their transportation. The massive parts, such as the gun and its carriage, had to be conveyed by standard gage railway or by ship to some place adjacent to the field of operations, whence it was customary to lay a light military railroad or devise other special means for transporting the batteries to the locations assigned to them. Before the mortars could be erected and placed in working order, it was necessary to provide heavy masonry foundations, of sufficient area and mass to withstand the heavy shock of recoil. It can readily be understood that this preliminary work entailed the loss of much valuable time.

This was the method employed by the Japanese in the reduction of Port Arthur. This enterprising people was the first to employ 11-inch siege guns for the reduction of permanent fortifications. They dismantled a large number of their coast defense mortars in Japan; transported them by sea to the port of Dalny; laid a light military railroad from Dalny to the base at the hills encircling Port Arthur; built heavy concrete foundations; and erected upon them the mortars and their gun carriages. It was these siege pieces which assisted in the sinking of the Russian ships in Port Arthur, and contributed very largely to the reduction of the forts which crowned the hills around that city.

The heaviest French siege piece is a 10.7-inch howitzer. This piece was tested during the maneuvers of 1907 in the siege of Langres. For field work or for transportation for the siege of fortifications it is horse-drawn, being carried in four parts on separate carriages, one carrying the gun, another the carriage, a third the slide, and a fourth the platform.

The German 11-inch mortar marks a great stride in power and weight, and particularly in mobility, over any other mobile artillery as yet constructed. The outstanding feature of this great mortar is that it is so mounted that the gun and its carriage can be hauled either by motors or by horse-power at a speed approximating that of the lighter siege artillery, and that when it has reached the designated position, it takes but a short time to have the gun in battery, ready for the attack.

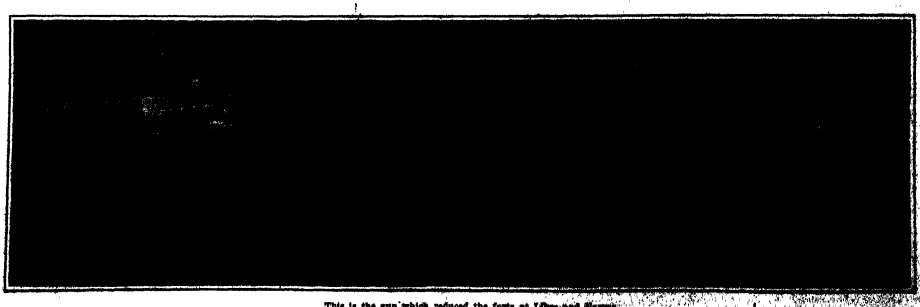
The barrel of the gun is made of steel, and it consists of the inner tube and an outer jacket, the total length of the gun being 11 feet. The breech is opened and closed by turning a handle through a horizontal arc for about 135 degrees; and a safety device operated by hand is provided which prevents premature firing or accidental opening of the breech. In spite of the fact that the breech mechanism weighs over 1,100 pounds, the construction is such that the opening and closing of it can be effected easily with one hand and in a few seconds time.

The gun is transported on two separate vehicles, each of which can be hauled as shown in our illustration by a single motor truck. During transportation one unit consists of the gun carriage, slide, recoil cylinders, trail, and permanent axle and wheels, the last-named being fitted with broad flat feet after the manner of the Diplock pedrail. The after end of the trail during transportation is mounted upon a pair of wheels as shown in the illustration. The gun itself is transported upon a carriage upon which it is placed in such a position that the majority of the weight will come upon a pair of pedrail wheels.

To mount the gun when it has reached its assigned place, all that is necessary is to back up the section carrying the gun against the section constituting the mount, and then, by means of wire cables, draw the gun forward into the sleeve and bolt the lug (which is shown on the top of the gun near the breech) to the piston rod of the recoil cylinder. The gun transporting section is then drawn away, the trail is lowered to the ground, and the gun is ready for firing.

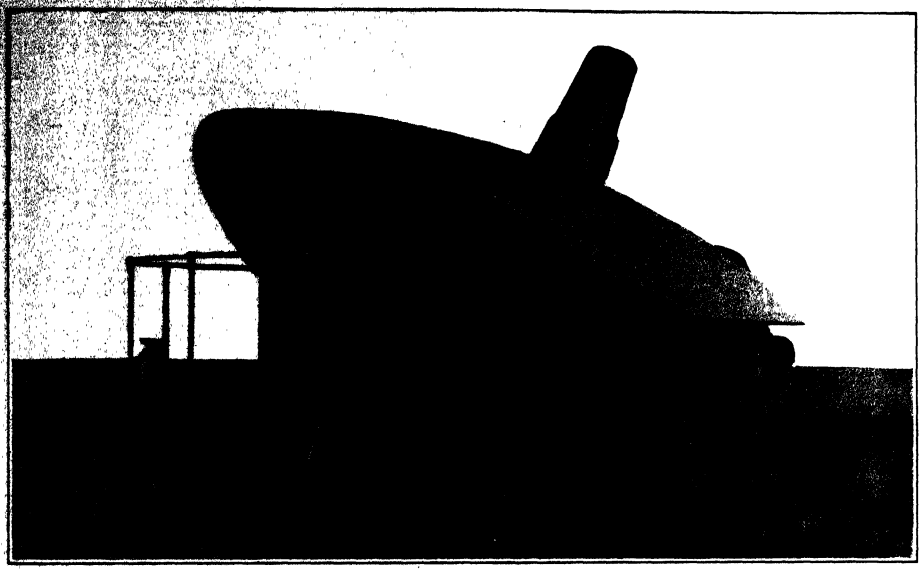
The training gear gives a maximum elevation to the mortar of 65 degrees, and it works upon a rapid system. The gun can also be traversed through an arc of 10 degrees horizontally, that is, five degrees on either side of the longitudinal center line of the carriage. The upper part of the cradle in which the gun slides carries a group of three cylinders. The central cylinder acts as a recoil brake, while that on either side is an air reservoir. The gun, as we have said, is connected, not to the brake cylinders, but to the piston rod; the brake cylinder remains stationary during the recoil, and it is the piston rod and the piston which move to the rear with the gun.

Exact particulars as to the weight of shell and bal-



This is the gun which reduced the forts at Liege and Namur.

The 11-inch mortar in transit on a separate carriage, from which it is transferred to its mounting.



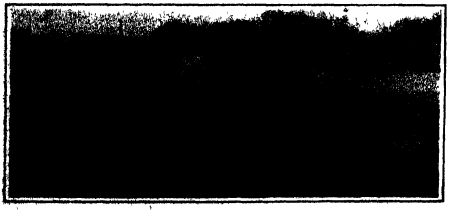
Krupp 11-inch siege mortar mounted on permanent concrete platform.

listic features of the 11-inch mortar are not available; but by comparison with our own 12-inch mortar it may be assumed that the following particulars are not far from the facts: The weight of the gun and its carriage, etc., for transportation is nearly 40 tons. The weight of the shell is about 760 pounds. The maximum range at an elevation of 65 degrees is 24,250 feet, and the maximum range at 42½ degrees elevation is a little over 33,000 feet.

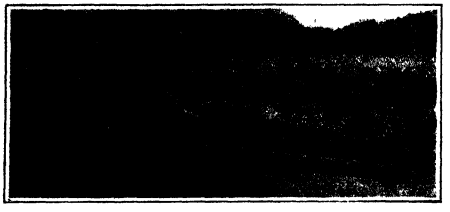
As upon the sea, so upon the land, the attack has overmastered the defense; for it may be stated with little fear of contradiction that a rain of 11-inch shell falling almost vertically from an altitude of several miles would suffice to destroy the strongest fortifications existing to-day. What the high-explosive mortar shell can accomplish on such fortifications as those of Liege and Namur is shown by the illustrations of the wreckage of these forts to be found on another page of this issue; and we very much doubt if even the strongest forts around Paris would have shared a better fate if the Germans had succeeded in reaching the French capital. The Grusson turrets afforded ample protection against the direct fire of high velocity rifles and the high angle fire of the lighter siege guns which were in vogue when these forts were designed, but against these enormous 11-inch mortars, fitted with delayed-action fuses and filled with the most modern high explosives, they are helpless.

It must be admitted, however, that the very qualities of weight and power which make the 11-inch mortar such a formidable piece, nevertheless constitute a most serious problem of transportation. In spite of the skill with which the design has been worked out, with its large diameter pedrail wheels, the weight of one of these mortars is such that it demands the very best of conditions of roadway for its successful, or, at least, for its speedy transportation. To handle these pieces successfully, whether in advance or retreat, calls for

(Concluded on page 286)



Krupp 7.5-centimeter field-piece in battery.



German 4.7-inch rapid-fire field howitzer.



The 420-inch field mortar, limbered up for transit.



The Krupp 8.25-inch field mortar in firing position.

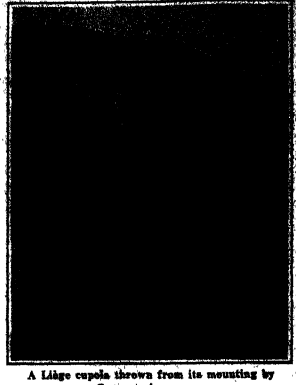


Effect of German heavy siege gun fire on Liège armored cupolas.

The Turret Fort

A Description of the Famous Gruson Armored Turret Used in European Fortifications

By Major A. G. Piorkowski



A Liège cupola thrown from its mounting by German siege guns.

AFTER their first swift advance into Belgium and the withdrawal of the Belgian government from Brussels, the Germans set about the business of besieging Antwerp, not only because it had acquired new importance as the capital of Belgium, but because of its strategic value as an important point. The turning of the left wing of the Allies southward, moreover, facilitated the investment of the city. Although the Germans have been diverted from a formal siege, Antwerp claims its share of attention, chiefly because of the character of its fortifications.

Antwerp has always been a fortress and its history is full of fighting and sieges. But now its fortifications count among the most modern, and are considered an example of the present state of the military engineer's art and science. Their designer and builder, Gen. A. H. Brialmont, the Belgian engineer and writer on fortifications, has made himself famous not only by his work for the strongholds of Antwerp, but by his planning and building the defenses of Bucharest, the capital of Roumania, and of Liège and Namur. His close connection and friendship with Col. Max Schumann of the Gruson Works of Magdeburg in Germany enabled him to introduce iron and steel batteries and turrets into his fortifications, and these modern constructions probably will now have their first test in real warfare. I may say right here that modern ordnance and gunnery have made great progress in the last thirty years, since Antwerp's ramparts and forts were built, as they are now, so that it is quite doubtful whether they would prove formidable and make the siege a long one. The range and power of penetration and accuracy of modern ordnance is far superior to what it was when the tests at Bucharest, in 1883, and at Spezia, Italy, in 1886, spread the fame of the so-called Gruson turrets, which form the citadels of the Antwerp forts, and which were then adopted by the military engineers of Germany, Austria, Italy, Belgium, Roumania, Switzerland, and Holland.

Hermann Gruson was an engineer of great talent, born in Magdeburg, and whose works, now owned by the Krupp Company, are near that city. He invented what is often called the Gruson metal, a special excellent low carbon cast iron, chilled by being cast in partly iron molds, thereby attaining an extraordinary hardness of surface, without apparently weakening the tenacity.

He first used this metal for parts of machinery that required such hardness, also for railway switches and crossings and other parts which require great resistance against wearing off by friction. His next step was to use his metal for armor piercing projectiles which were very efficient for penetrating into and perforating armor plates, which at that time were rolled of soft iron or [illegible]. His successes in this direction carried him to the construction of chilled cast iron armor batteries and rotating turrets of such metal. The larger size and higher weight of the castings for armor brought him new problems to solve, and quite a number of inventions and new constructions were the result. Special furnaces, large troughs in which the molten metal was poured to be collected in the necessary quantity, where it was stirred and allowed to cool off to the proper temperature before it was run into the mold so as to solidify quickly after casting; new cranes to move the enormous molds, new tools to work the hard surfaces, in fact, nearly every part of the manufacture was a novelty, and made it a monopoly for Gruson.

The bulk of the Gruson armor and the hardness of its outer surface, however, are not the only great qualities which make it a powerful shield against the heavy armor-piercing projectiles. It is its characteristic dome-like shape, its curved outline, which prevent the shell from striking under an angle of impact greater than 45 degrees. Instead of striking by its point, the shell strikes by its side, is shattered, and the pieces glance off and leave the turret practically uninjured.

In the Spezia trials the test plate weighed 120 tons, the cast iron part of the mold in which it was cast weighed 180 tons; a special combination of four railway platform cars was built to carry the big plate from Magdeburg to Spezia. It was fired upon from an Armstrong 100-ton gun. To make the fire more efficient the plate was tipped up on an angle so as to increase the impact angle. It was placed in a tunnel to receive the pieces of the shattered shell. The first round left the surface intact, simply smoothing and polishing it at the striking point. As the firing was continued, the hits lying close together, cracks appeared, radiating from the striking points and pentrating into the interior normal to the surface. As these cracks met and formed a network of fissures pieces separated from the main body, but being more or less of the shape of vault stones, remained in place and helped even after a number of heavy rounds to what remained of the resistance of the plate. In this manner the test-plate surpassed by its resistance anything that was expected from it by the number of distinguished engineers who witnessed the test. The plates of this kind in contrast to rolled iron or steel plates are made with a thickness varying according to the inclination of the surface toward the horizontal. The Spezia test plate and the plates for the two great Italian turrets at Spezia and Taranto were 60 inches thick in the breast and tapered off to 24 inches where they join the top plates of the cupola. We need hardly say that turrets consisting of 15 such segments and 2 semi-circular top plates cannot be placed on a ship. The Gruson turrets are all in land defenses, the bigger ones in coast defenses. The plates need no backing and no bolts to fasten them and hold them together; they are only dovetailed by steel keys at the joints. The circle of plates rests on a framework made of plates and angles of rolled iron or steel riveted, and this again rests on a circle of rollers, rotating on a strong circular rail. From the breast of the cupola down this substructure with the gun-carriages, rotating machinery, and all the rest is protected by another, fixed, circle of chilled iron plates from whose upper surface runs the glacis of stone and concrete. This so-called circular or ring gallery allows the communication between turret and the masonry cellars for the service—the engines, pumps, magazines, and all other necessities.

The gun or guns rest and move in minimum embrasure gun-carriages. These represent another important invention of Gruson's. As the gun's lateral direction is given by the rotation of the turret itself, the gun-carriages are only designed to control the elevation of the guns. But the horizontal axis of this movement is not the line through the center of the trunnions as in most guns. If it were so the guns swinging up and down would leave open spaces above and below the guns in the portholes. To prevent this the horizontal axis is laid in the middle of the embrasure, which close as near as possible round the outer surface of the guns and do not allow any big splinters of the enemy's shell to penetrate into the interior of the turret. For this purpose the trunnions are in [illegible] bearings, which slide up and down in guidings bent round that axis; which movement is made by means of hydraulic rams and controlled by the aiming gunners.

The gun-carriages and through them the guns themselves are supported by heavy girders connected with the framework substructure, and so of course share the rotation of the turret. The rollers for the rotation are of Gruson metal, and so are the broad circular rails for these rollers, and are laid with great accuracy on strong, solid stone foundations. Great accuracy and solidity is a necessity in order to rotate the great weight of the turret, substructure, gun-carriages and guns on a perfectly horizontal basis with comparative facility.

In the case of [illegible] two Italian 16-inch [illegible] ever built, [illegible] a total of [illegible] turns, [illegible] gun. [illegible] exhibited, in [illegible] Fair at [illegible] shown [illegible] the [illegible] Buffalo [illegible]

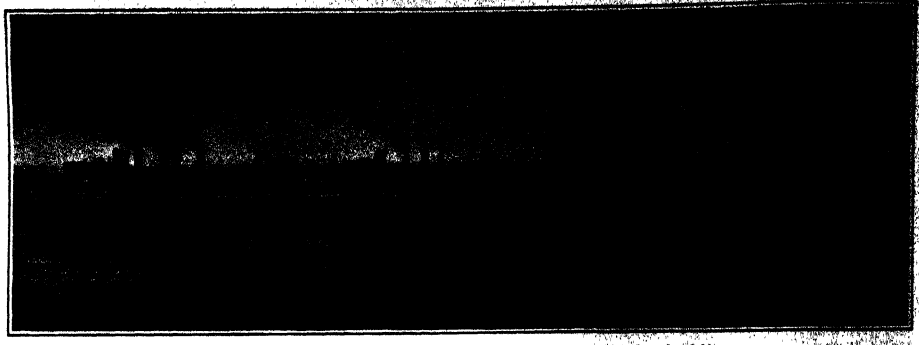


All that is seen of the Gruson turret by the enemy.

(Continued on page 276)

THE GRUSON ARMORED TURRET AND ITS INTERNAL CONSTRUCTION. TURRETS OF THIS AND SIMILAR TYPES ARE TO BE FOUND IN MANY EUROPEAN FORTIFICATIONS.

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Destroyers sweeping for mines by dragging a length of chain cable through the mine field.

Attack and Defense by Submarine Mines

The Most Easily Prepared and Most Dreaded Form of Naval Warfare

BECAUSE of its absolute invisibility, the submarine mine in its present state of development is the most deadly form of naval warfare. Certainly it has to its credit the greatest disasters to ships of the first class and the greatest number of such disasters during the past decade of naval history. During the operations on Port Arthur it was the floating mine which sent to the bottom two of the finest battleships of the Japanese fleet. It was a floating mine also which sank the "Petropavlovsk," when Admiral Makaroff was leading the Russian fleet out of Port Arthur, in which disaster the admiral and nearly all of the officers and crew of the ship, together with the Russian artist Vereschagin, went down with the ship. By mines, also, several war vessels of less importance were lost during the same war, and on more than one occasion Russian battleships engaged in operations at or near the entrances to Port Arthur were struck and so far disabled as to be out of action for several months' time.

As compared with torpedo attack, mining has the advantage of greater secrecy and invisibility; and this is true even when the torpedo is launched from the submarine. For effective attack, torpedoes must be fired either from battleships, cruisers or destroyers, or submarines.

In the case of each class of vessel, a ship, from the moment it sights the enemy, knows that within certain ranges it is liable to torpedo attack; and even in the case of the submarine, which must come occasionally to the surface and during most of the period of attack must occasionally have its periscope above the surface, there is a reasonable expectation that with a careful watch, some signs of the approaching danger will be detected.

In the case of the submarine mine, however, the element of secrecy is so perfect that, if it so happens that the mine field has not been previously located, a fleet under way has no possible means of knowing when or where it may encounter these deadly machines. It is true that, when the mine field has been located, or in waters where its presence is to be expected, mines may be removed by the operation known as "sweeping," as will be explained later in the present article; but no amount of sweeping, nor the most extensive scouting, can rid the harbors and high seas which form the scheme of naval operation of this most deadly menace.

Another element which renders the mine of such deadly character is the fact that its explosive charge is not limited in amount as it is in the case of the torpedo, which generally does not carry much over 200 pounds of guncotton. The mines can be made of any desired size, and charges of as high as 500 pounds of guncotton may be contained within them. A modern dreadnought, with its extensive system of subdivision and its interior bulkheads placed so as to limit the explosive effect of a torpedo, can receive the blows of several torpedoes without being sent to the bottom. But the detonation of a single mine of large size against the side or bottom of the largest dreadnought might conceivably be sufficient to send it to the bottom; particularly if, as has so frequently happened, the shock and heat of the detonated mine has been sufficient to set off the whole of a ship's magazine. This was what happened to the "Maine" when she was sunk in Havana harbor, and similar results accounted for the sinking of the "Petropavlovsk" and the Japanese "Hatsuse."

Although the broad principle of operation of the various types is similar, submarine mines may be classified under three divisions. First, coast defense mines which are permanently anchored at a certain depth and are arranged, through electrical connections, to be exploded at will by an observer in a concealed station on shore; second, floating mines arranged to explode on contact with a ship, which are strewn broadcast by mine-laying vessels over those waters which are likely to be traversed by the ships of the enemy; third, contact mines, which are anchored in selected waters where the depth is not excessive, and are provided with an automatic mechanism that causes the mines to float at a predetermined depth, generally about fifteen feet below the surface of the sea.

The first type, harbor defense mines, is shown in the first two of the illustrations on the following page. The lower cut of these two represents the method of mining adopted during the Spanish-American war as a defense to the entrances to New York harbor such, for instance, as was used in the Narrows. In this case the mines were anchored by lengths of cable, corresponding to the depths of the channel, to heavy anchorage weights placed on the bottom, the buoyant spherical mine itself which contained the explosive, floating at a depth of ten to fifteen feet below the surface. They were laid in successive rows, transversely to the channel, and connected by electric cables with a concealed observation station on shore. In some cases mines of this type are detonated from shore when a ship is judged to be within effective range of the explosion. In other cases they are arranged to be self-firing when struck by a ship. They can also be arranged as electrical contact mines, which, on being struck by a ship, give notice by the ringing of a bell to an operator on shore, who, by the throw of a switch, fires the mine. In shallow water the mine may be laid directly on the bottom, when it is known as a ground mine; but where the depth is so great as to interfere with the destructive force of the detonation, the explosive is carried in a buoyant cylinder or sphere in the manner shown in the illustration.

The type in general use in the coast defenses in this country is the electro-contact mine, and the first of the illustrations on the following page shows a "grand group" of several mines, with its cables connected to the firing station on shore. The mines are planted in successive rows across the channel to be defended.



Anchored mines, connected in pairs by cable, which, caught by the ship [illegible]

[illegible] a small shield [illegible] mines. [illegible] are grouped in [illegible] or "mine groups," which consist of [illegible] mines in charge of them. Some distance [illegible] the line of mines, there lies on the bottom of the channel a small junction box, from which [illegible] cables extend, each leading to a triple junction box which in turn controls by small group of three mines. From the grand junction box, also, the multiple cable finds its way to the switchboard connection in the operating room on shore.

The grand junction box is placed at the center of the line of mines and about 300 feet to the rear. The triple junction boxes are laid in a straight line at intervals of 600 feet, from each of these boxes separate mines, lead to each of three mines, the mines, twenty-one in all, being spaced 600 feet apart, in a line which extends for two thousand feet across the channel. Each mine is anchored by a cable to an anchor, the length of the cables being such that each mine will float at a depth of ten or twelve feet below the surface of the water.

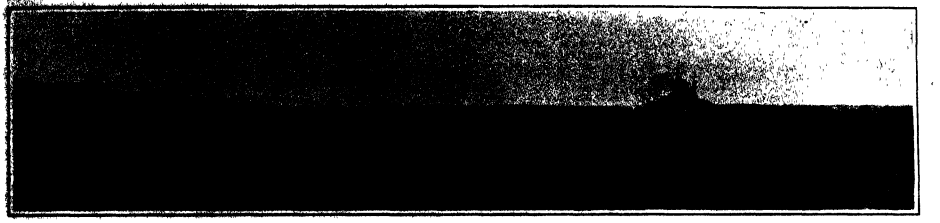
Now, it can readily be seen that since the modern warship is from 60 to nearly 100 feet in width, it would be impossible for an enemy's vessel to pass through two or three successive lines of mines, disposed as above, without coming in contact with at least two or three.

By an ingenious arrangement, one, three, or the whole grand group of mines can be fired, either from the operating room ashore, or by contact with a ship, all at the will of the operator. It is believed that for quick execution, reliability, and absolute destructive power, there is nothing equal to our Coast Defense Submarine Mine System of laying and operation.

No mine field is complete, or can ever be thoroughly effective, unless it is protected by rapid-fire guns. It is possible for small boats, launches, etc., to be sent forward ahead of the ships, and set off the mines by exploding large charges of dynamite in the mine field. If the mines are within the "sympathetic radius" of the explosions they will be exploded by the shock. The most effective protection against such countermining or against "sweeping," as it is called, is by flanking the field with batteries of rapid-fire guns.

We present also several detailed and general illustrations of the type of contact mine which is in most

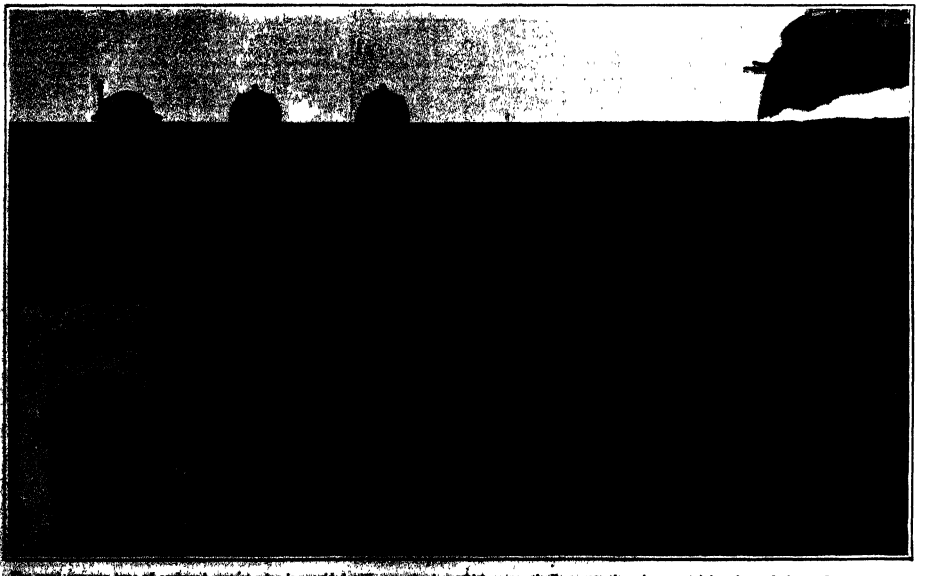
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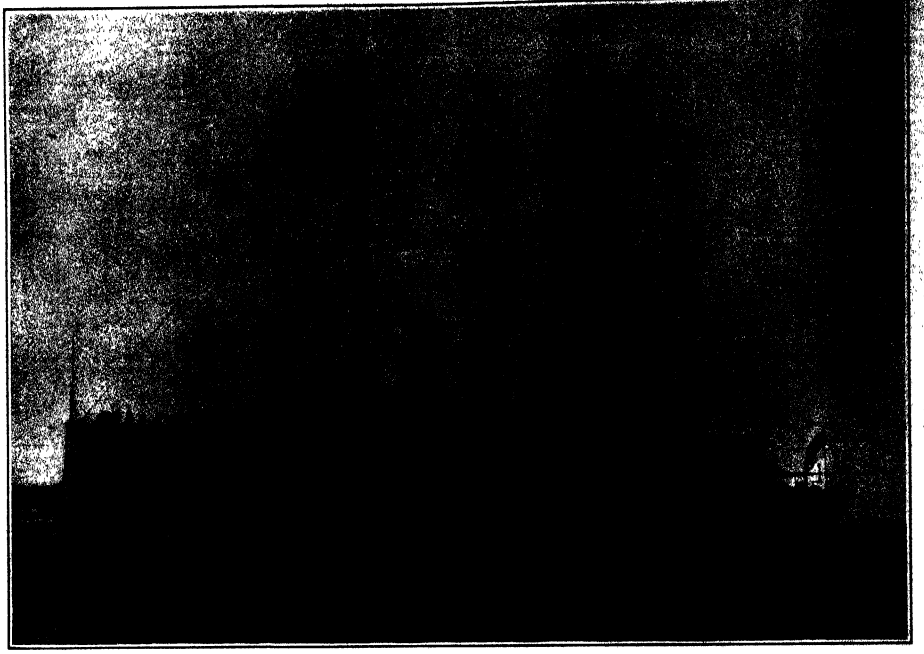
A group of mines for the defense of a harbor channel.



The system of mining used in the Narrows, New York Harbor, during the Spanish War.



The [illegible] type of [illegible] mine is provided with a [illegible] which automatically causes the sphere containing the explosive to float at a predetermined depth of about fifteen feet.



British armored cruiser "Aboukir," also "Cressy" and "Hogue," sunk by German submarines in the North Sea.
Date, 1900. Speed, 20 knots. Displacement, 12,000 tons. Guns, two 9.2-inch, twelve 6-inch. Side armor, 6-inch.

The Submarine Vindicated

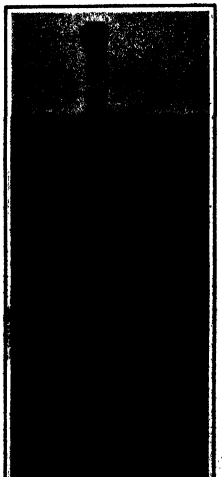
The Sinking of Three Large Cruisers Proves the Deadly Efficiency of Submarine Attack

IT has long been recognized among naval strategists and by the student of naval warfare under modern conditions, that the power which has a great inferiority in battleship strength will retire its capital ships within its own harbors and fortified bases, accepting blockade by the enemy, and seek to reduce his preponderance of strength by mining and by destroyer and submarine attack.

The wisdom of this policy is evident, when we bear in mind the fact that the development of naval war material during the past few decades has been of such a character as to greatly favor the defense and render the work of blockading far more hazardous than it was in the days of sail power and the smooth bore, or even in that period which preceded the successful development of the torpedo and the submarine. The menace of the mine and the submarine is so great that its moral effect upon the blockading fleet is an asset of enormous value to the defense. The only possible protection of the blockading fleet against the submarine is for its ships to keep continually on the move, and if the ships are thus in motion, they are continually exposed to danger of contact with anchored or floating mines. No matter how great may be the watchfulness of the blockading force, there will be conditions of sea and weather which will greatly favor submarine and destroyer attack; and in the course of a long blockade, provided the blockaded fleets are full of resourcefulness and daring, it is inevitable that there will be a loss of ships which, in the course of time, will cut down the numerical superiority of the blockading force.

Very wisely, the German admiralty, in view of the overwhelming strength of the allied naval forces, has adopted a strictly defensive policy, at least so far as its capital ships are concerned. These are doubtless to be found in the various strongly defended harbors of the German coast line, the entrance channels to which are heavily mined, with the mine fields covered by batteries of rapid-fire guns which render it impossible for the enemy to adopt countermining or mine-sweeping operations.

Although the submarine fleet of Great Britain numbered at the outbreak of war seventy vessels, as against twenty-one in commission for Germany, the difference is more than offset by the fact that the German submarines are at liberty to pass out into the high seas and carry on their operations in waters that are free from any obstructions. The British submarines



Observing by means of the periscope.

find their way barred by mine fields, heavy steel netting, and various obstructive work of a permanent character, which prevent their entrance to the German harbors and roadsteads. It is true that press reports speak of a British submarine having entered one of the harbors, and sunk the German cruiser "Hela," but this we very much doubt, for the reason that as yet it has received no official confirmation.

Although the German destroyers have, so far, conducted *no attack in force against* the blockading fleet, it is certain that, from the very declaration of war, the submarines have been cruising at will in the North Sea; and they have at last scored a success, in the sinking of three British armored cruisers of 12,000 tons displacement, which must be recorded as the most brilliant naval success thus far achieved in the present war, and which establishes, at a stroke, the deadly efficiency of this, the latest form of naval warfare.

It is in the moral prestige acquired, rather than in the material loss to the enemy, that the value of this German success is to be estimated. Not only has it shown the wisdom of the defensive tactics adopted by the German admiralty; but it will have a profound effect in provoking a sense of insecurity in the enormous fleet, estimated at some 200 ships, which is holding the German battleship fleet in its home waters.

The "Aboukir" and her sisters, the "Cressy" and "Hogue," are ships of 12,000 tons displacement, mounting two 9.2-inch and twelve 6-inch guns, and protected by a partial belt of 6-inch armor. They were laid down in 1899-1900, and therefore are, in design, about fifteen years old. Hence, they belong to the class of obsolescent vessels, that is, vessels of the reserve, which in a few years time would be struck off the active list. Their best recent speed was from eighteen to twenty knots. Since they belonged to the reserve at the time of the disaster, they were manned by reserve forces. Although their fighting and maneuvering qualities were not comparable to those of the armored ships of the "Minotaur" and "Cochrane" classes, they were fine ships in their day, and were still very serviceable for the patrol duties in which they were engaged at the time of the disaster.

As usual, reports from the English and German side vary greatly. Berlin states that the three ships were sunk by a single submarine, the "U-9"; on the other hand, the survivors of the ship seem to agree that the attack was made by a flotilla of five or more submarines, and that it was well



Successful submarine attack at close range.

planned and deliberately carried out. To an impartial observer the latter would seem to be the true account; and the success of the submarine loses none of its brilliance if we accept the British statement.

Judging from the accounts of the rescued officers, it would seem that the cruisers were accompanied with the usual flotilla of destroyers, thrown around them as a screen against submarine and destroyer attack. The flotilla had left the cruisers about six in the morning, probably to repair to port for coaling, and a relieving flotilla was due to join them later in the day.

Because of its relatively low speed, the submarine is limited in its opportunities of getting near to faster ships that are in motion; and it looks as though the Germans had made use of a rather clever ruse to draw the British ships within range of torpedo attack. The cruisers are reported to have sighted a number of fishing boats which it was discovered were laying mines. They attacked them and immediately the German submarines were reported as approaching from the fishing boat fleet, "the white wake left by the periscopes frothing into view along a wide front." The attack seems to have been boldly carried out, some of the destroyers having their conning towers awash in the earlier phase of the advance. The "Aboukir" was the first cruiser to be torpedoed. The "Hogue" and "Cressy" drew up to rescue the "Aboukir's" crew and were themselves successively torpedoed. It seems to have taken from twenty minutes to less than three quarters of an hour to send the three ships to the bottom. The total loss of officers and men was about 1,600. The survivors claim the attack was so boldly made, that at times the conning towers were exposed at close range, and that two or more of the submarines were struck and probably disabled. Evidence on this point, however, is at present obscure.

The following description of the construction and operation of the submarine will apply in its principles to most of the various types employed in the present war.

The form of the hull is generally described as cigar-shaped. It is built of the very best quality of mild steel, and the workmanship is of the highest order, for the reason that every seam and rivet must be perfectly tight, in view of the service which the boat is called upon to perform. Not only do vessels of this type undergo all the stresses of sea and weather which other vessels are subjected to, but in addition they are required to navigate at considerable depths below the surface of the water. At these depths the pressure of the water is great, so that the hull must be made sufficiently strong to withstand it.

For submerged work large storage batteries are provided, which furnish energy sufficient to drive the boat from ten to eleven knots for a period of over an hour. The same electrical energy will drive her at a lower speed for a much longer time

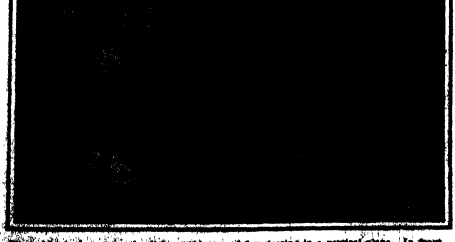
There are two distinct conditions in which the boat may be used. In the first, commonly known as the surface condition, the boat is prepared for cruising. A considerable portion of her hull is above water, a removable navigating bridge is in place, and she is driven by large, powerful, internal-combustion engines. Under these conditions she is managed in about the same way as any vessel built to run upon the surface. As for sea-going qualities, the submarines of our own service have been found in practice to be excellent. In ordinary weather they are fully as comfortable as any surface craft of the same dimensions, and even in the heaviest weather they are entirely seaworthy.

The second distinct condition exists when the boat is submerged. To pass from the surface to the submerged condition, certain valves in the interior of the boat are opened. This allows the water from the sea to run into great tanks built within the boat, and thus virtually sink her. These tanks are closely gaged, so that just the required amount of water is taken in. Under normal conditions, when the boat is at rest with the ballast tanks filled, she will have a few hundred pounds reserve buoyancy, which is represented by the top of her conning tower protruding above the water If desired, this buoyancy may be entirely destroyed by admitting a small additional amount of water, equal in volume to the volume of that part of the conning tower above water. While in the submerged condition, all communication with the outside atmosphere is necessarily cut off. The crew then breathes the air contained in the body of the boat. The amount of air originally contained within the hull is sufficient to support life with comfort for at least twenty-four hours But, in addition to the air thus contained, the boat carries a large supply of compressed air in steel flasks, which, if used for breathing purposes, would be sufficient for a number of days

After having brought the boat to the submerged condition in the manner above described, powerful electric motors are started by throwing in a switch These motors derive their energy from storage batteries contained in the boat, and drive the propellers. The same storage batteries furnish current for numerous auxiliary motors used for pumping steering, handling torpedoes, etc.

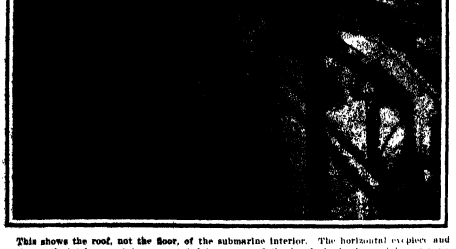
The motion of the boat when under way is controlled by two sets of rudders; one of these sets, known as the vertical rudders, directs the boat's course to port or starboard just as does the rudder of an ordinary ship. In addition, there are provided horizontal rudders, which serve to control the motion of the boat in a horizontal plane; that is to say, the depth at which she runs is regulated by these rudders. For steering in the horizontal plane, instruments are provided, so that the boat may be navigated with the same degree of accuracy as boats on the surface. The first

(Concluded on page 288)



The hand wheel operates the diving rudders used for steering in a vertical plane. In front of the wheel is a gage whose pointer shows the depth of the boat. The curved dark line below pointer is a spirit level which shows the inclination of the boat.

Diving wheel and depth pressure gage.



This shows the roof, not the floor, of the submarine interior. The horizontal eyepiece and the vertical telescope tube are rotated by means of the hand wheel whose pinion engages an internal gear ring.

Eyepiece at bottom of periscope.

THE INTERIOR OF A MODERN SUBMARINE

List of Ships of the Triple Entente and the Dual Alliance

Probable Additions of New Ships During the Ensuing Six Months

THE accompanying list of the ships in active commission in the various fleets now engaged in the Great War of the Nations is complete to September 1st, 1914. Vessels that have been sunk or been driven to neutral ports since the opening of the war have been omitted. These include for the British fleet, the scout cruisers "Amphion" and "Pathfinder," sunk by mines, and the armored cruisers "Aboukir," "Cressy," and "Hogue," sunk by submarine attack, and for Germany, the scout cruisers "Koln" and "Mainz," and the cruiser "Ariadne," and two torpedo-boat destroyers lost in the engagement of August 28th, at the mouth of the Elbe, the scout cruiser run aground and blown up in the Baltic, the battle-cruiser "Goeben," and the scout-cruiser "Breslau," which have been driven to the Dardanelles—neutral waters. The tables give the date of launch and the displacement of the battleships, and the speed and displacement of the cruisers.

It will be understood that at any time, and even before these tables are published, for which we are indebted to Brassey, a great naval battle may necessitate the revision of these lists. But since the names of vessels that may be lost will be published in the various official bulletins, the reader will be able to make the necessary eliminations from the tables as thus presented.

At present the situation is such that most of the powers are in a position to complete at their various protected naval bases and shipbuilding establishments, the vessels which were under construction when the war opened. England, having the full command of the sea, will be quite unhindered in this work; Germany, moreover, with her naval bases and government shipbuilding yards strongly protected by fortifications, mines, etc., is able to do the same, and probably will be able to pursue her shipbuilding policy unhindered for some months to come. France is in a similar position, and Austria and Russia, though opposed by overwhelming naval forces, are not as yet under fire from the sea nor are their shipbuilding plants seriously threatened by land forces.

The ships which are

TORPEDO FLOTILLAS.

Class	GREAT BRITAIN. Built.	Building.	Total.	GERMANY. Built.	Building.	Total.	AUSTRIA-HUNGARY. Built.	Building.	Total.	FRANCE. Built	Building.	Total.	RUSSIA. Built.	Building.	Total.
Destroyers	218	20	238†	142‡	10	152¶	19		19	83	4	87	105	36	141
Torpedo Boats,* 1st and 2nd Class	70	..	70	47	..	47	56	27	85	153	..	153	25	..	25
Submarine Boats	76	20	96	27§	12	39	10	4	14	70	23	93	25	18	43

* Excluding boats over 20 years old. † 12 projected. ‡ 2 sunk. § 1 sunk. ¶ 12 projected.
Three British Dominion destroyers built, three under construction, two Dominion submarines.

TABLE I.—MODERN BATTLESHIPS.

GREAT BRITAIN. Launched	Name	Displacement	GERMANY. Launched.	Name.	Displacement.	AUSTRIA-HUNGARY. Launched	Name	Displacement.
		tons.			tons.			tons.
	Royal Sovereign			*Ers K. Fried. III*		1911	Viribus Unitis	
	Royal Oak			*Ers Wurtt*	29,000	1912	Prins Eugen	20,000
	Revenge	25,750		*Kronprinz*			Szent Istvan	
	Resolution		1914			1912	Tegetthoff	
	Ramillies		1913	*Grosser Kurfurst*	25,573		4 ships	80,000
	Malaya		1913	*Markgraf*				
	Barham		1913	*Konig*			FRANCE	
1913	*Queen Elizabeth*	27,500	1911	Kaiserin				
1913	*Warspite*		1912	Konig Albert				
	Valiant		1912	Prinz Luitpold	24,310		*Bearn*	
1912	Iron Duke		1911	Friedrich der Grosse			*Languedoc*	24,830
1912	Marlborough	25,000	1911	Kaiser			*Flandre*	
1913	Emperor of India		1910	Lothringen			*Gascogne*	23,177
1913	Benbow		1909	Thuringen	22,500		*Normandie*	
1911	King George V		1909	Oldenland		1913	*Brennet*	
1912	Ajax	23,000	1909	Helgoland		1913	*Lorraine*	23,100
1912	Audacious		1908	Posen		1913	*Provence*	
1911	Centurion		1908	Rheinland	18,600	1912	France	
1911	Conqueror		1908	Nassau		1912	Paris	
1911	Monarch		1908	Westfalen		1911	Courbet	23,100
1911	Thunderer	22,500				1911	Joan Bart	
1910	Orion			20 ships	479,350	1909	Danton	
1910	Colossus	20,000				1909	Condorcet	
1910	Hercules			RUSSIA		1909	Diderot	18,028
1909	Neptune	19,900				1908	Mirabeau	
1908	Collingwood			*Ekaterina II*		1910	Verginiaud	
1908	St. Vincent	19,250	1914	*Alexander III*	22,500	1909	Volkiers	
1909	Vanguard		1914	*Imperatritsa Maria*				
1907	Bellerophon		1911	*Sevastopol*			18 ships	204,249
1907	Temeraire	18,600	1911	*Petropavlosk*	23,000			
1907	Superb		1911	*Gangut*				
1906	Dreadnought	17,900	1911	*Poltava*				
1906	Lord Nelson	16,500	1907	Imperator Pavel I	17,400			
1906	Agamemnon		1906	Andrei Pervovanyi				
	34 ships	772,600		9 ships	194,300			

* Completed in three (3) months. † Completed in six (6) months.

TABLE II.—BATTLE-CRUISERS

GREAT BRITAIN Launched	Name	Displacement	GERMANY Launched	Name	Displacement.	RUSSIA Launched	Name	Displacement
		tons			tons.			tons
1913	Tiger	28,500		*Ers Vict Luise*			*Borodino*	
1912	Queen Mary	27,000		*Ers Hertha*	30,000		*Ismail*	32,200
1911	Princess Royal	26,350	1913	Derfflinger			*Nesorin*	
1910	Lion		1913	*Lutzow*			*Kinburn*	
1911	New Zealand	18,800	1912	Seydlitz	24,640			
1911	Australia	18,800	1910	Moltke	22,940			
1909	Indefatigable	18,750	1909	Von der Tann	18,700			
1907	Indomitable							
1907	Inflexible	17,250						
1907	Invincible							
	10 ships	216,400		7 ships	185,980		4 ships	128,800

TABLE III.—OLDER BATTLESHIPS

GREAT BRITAIN Launched	Name	Displacement	GERMANY Launched	Name.	Displacement.	AUSTRIA-HUNGARY Launched	Name	Displacement
		tons.			tons.			tons.
1903	Edward VII.		1904	Deutschland		1908	Ers. Franz Ferdinand	
1903	Commonwealth		1905	Hannover		1908	Radetsky	14,226
1903	Dominion		1905	Pommern	13,040	1910	Zrinyi	
1903	Hindustan	16,350	1906	Schlesien		1904	Ers. Friedrich	
1904	Zealandia		1906	Schleswig-Holstein		1903	Ers. Karl	10,483
1905	Africa		1902	Braunschweig		1905	Ferdinand Max	
1904	Britannia		1903	Elsass		1901	Arpad	
1905	Hibernia		1903	Hessen	12,997	1902	Babenberg	8,208
1903	Swiftsure		1903	Preussen		1900	Habsburg	
1903	Triumph	11,800	1904	Lothringen				
1902	Queen	15,000	1900	Wittelsbach			9 ships	58,601
1902	Prince of Wales		1901	Wettin				
1901	Albemarle		1901	Zahringen	11,643			
1901	Cornwallis		1901	Mecklenburg				
1901	Duncan	14,000	1901	Schwaben				
1901	Exmouth		1896	Kaiser Friedrich III			FRANCE.	
1901	Russell		1897	Kaiser Wilhelm II				
1898	Formidable		1899	Kaiser Wilhelm der Grosse	10,974			
1898	Irresistible		1900	Kaiser Barbarossa				
1899	Implacable	15,000	1899	Kaiser Karl der Grosse		1903	Patrie	
1899	London					1902	Republique	
1899	Venerable			20 ships	243,370	1904	Justice	14,635
1899	Bulwark					1904	Verite	
1899	Canopus					1907	Patrie	
1899	Glory					1904	Democratie	
1898	Albion	12,950				1900	Vaillant	12,527
1898	Goliath			RUSSIA.		1903	Republique	12,027
1898	Ocean					1903	Liberte	11,755
1898	Vengeance					1903	Massena	11,080
1894	Magnificent					1903	Gaulois	11,105
1895	Majestic		1908	Ioann Zlatoust*		1903	Charlemagne	11,105
1895	Prince George	14,900	1906	Evstafi*	12,732	1904	Carnot	11,254
1895	Victorious		1903	Slava	13,516	1900	Henri IV	8,807
1896	Caesar		1901	Tsesarevitch	13,912			
1896	Hannibal		1900	Pantelemon*	12,582			
1896	Illustrious		1898	Tria Sviatitelia*	13,516			
1895	Jupiter							
1896	Mars							
	38 ships	350,300		6 ships	77,794		13 ships	163,508

* Black Sea.

completed and ready for service by the time the tables go to press type. Those vessels not completed in time for the next three months are designated by an asterisk and those which will be completed within the next six months are indicated by a single dagger.

We find then, that in the dreadnought class, by December 1st, the British fleet will be increased by the addition of the "Queen Elizabeth" and the "Warspite" and by the first of March by the addition of the "Malaya," the "Barham," and the "Valiant." All five of these ships are similar. They are of 27,500 tons displacement, and they are notable as being the first dreadnoughts to mount the 15-inch gun, of which they will carry eight in four turrets on the center line. The 15-inch gun fires a shell weighing 1,920 pounds, which is discharged with a muzzle velocity of 2,500 feet per second and a muzzle energy of 85,500 tons. The gun weighs 98.6 tons, and it is enormously superior at 10,000 yards to anything afloat to-day. Another remarkable feature of these ships is that they will have a speed of over 25 knots. Their belt armor will be from 13 to 14 inches in thickness, and this combination of qualities will enable them to overtake a fleeing dreadnought fleet, and by engaging the vessels at the rear of the line, force the enemy to accept a fleet action. In the scout class, Great Britain will add by December 1st, seven vessels of the type of the "Arethusa," which was engaged in the recent fight at the mouth of the Elbe. These ships mount two 6-inch and six 4-inch guns and carry four torpedo tubes for the 21-inch torpedo. The speed is 30 knots. By March 1st Great Britain will have added two more of this class.

France, by March 1st, will be able to add to her fleet the "Provence" and "Bretagne," vessels of 23,550 tons and 21 knots speed, mounting ten 13.4-inch guns and protected by a 10½-inch belt.

Russia, by March 1st, will have completed her first two dreadnoughts, "Gangut" and the "Sevastava," 23,000 tons and 23 knots speed, with

[illegible] These vessels are being built at Bremen, Hamburg, and Wilhelmshaven, respectively. Before the close of the year, Germany should add to her fine fleet of fast scout-cruisers the "Regensburg" and "Graudenz" of 27½ knots speed and 5,000 tons displacement, which are protected by a 4-inch belt and mount twelve 4-inch guns and two 18-inch torpedo tubes. By the first of March they should have two additional ships of this class, the "Gefion" and "Hela," ready for service.

All of the navies engaged in the war have a greater or less number of destroyers and submarines under construction, and all of them will doubtless make every effort that the exigencies of the war will permit to complete these craft and put them afloat. Great Britain and Germany, because of their large facilities, will make undoubtedly a considerable increase, but it is impossible to predict how many of these craft, and when, will be completed in the earlier months of the war.

The Fur-seal Industry of Alaska

FOR many years questions relation to the killing of fur seals in the seal islands of Alaska have been before various departments of the Government, and had their origin in the killing in open water by subjects of other nations of fur seals which, although breeding on the islands mentioned, spend most of their time in the water in search of food and in annual migrations. The interest of the Government lay mainly in the fact that they bred in the territory of the United States, and their pelts were highly valuable; and in 1870 their breeding place in Alaska was made a reservation, and their killing was subject to strict regulations as to the sex, age, and the number that could be killed. As the sexes are born in about equal [illegible] males might be killed if above one year old. Enterprising persons soon discovered that the laws did not protect the seals when the latter went into the ocean to feed or when they undertook their annual migrations from the breeding place to waters as far south as California. It was found also that these seals could be pursued and captured easily in the water. The killing of these animals in the water, unlike the killing of them on land in a well-regulated manner, involved a deadly menace to the species, for the reason that the water catches comprised from 50 to 85 per cent of females, while the land killing carefully excluded females. After many efforts treaties were concluded with Great Britain, Japan, and Russia under which sea killing was prohibited for fifteen years, and in all of the negotiations leading up to these treaties it was the contention of the United States Government, and admitted by the other nations, that the killing of breeding females in the sea, and not the killing of surplus males on land, was the cause of decrease in seal life; and these conclusions were apparently fully established by all independent investigators and scientific observers who have visited the seal island and studied the subject, and the results of the suspension of sea killing has apparently verified the findings.

Charges of fraud, corruption and negligence on the part of the Government employes and the lessees of the sealing rights on the Pribilof Islands having been made before Congress a committee was appointed to investigate the charges; and most of the testimony appears to have been directed to show that the diminishing numbers of seals has been due to the indiscriminate killing of the seals on land, and that great numbers of female and yearling seals have been taken by the lessees, contrary to law and their agreements. As a result of the investigations the person who was mainly instrumental in bringing the charges was sent to Alaska by the committee for the purpose of investigation; and a reopening of the investigation has been ordered.

A minority of the Congressional Committee in charge of the matter has however presented a report that takes exception to the conclusion of the majority, and in it they point out that the testimony taken does not substantiate the charge that female seals were killed right and left, but that it was intended to relate to the killing of yearlings, the sex of which it has been asserted cannot be distinguished. Much conflicting testimony was taken on this question, and while the minority report contends that the charges were disproved by evidence of a reliable character, the majority of the committee has ruled for a reopening of the case, which apparently means little more than a repetition of the testimony already taken

TABLE IV.—FIRST-CLASS CRUISERS

GREAT BRITAIN.

Speed.	Name.	Displacement.
knots.		tons.
22¼	Minotaur	
22¼	Shannon	14,600
22¼	Defence	
23	Duke of Edinburgh	
23	Black Prince	
23	Achilles	13,550
23	Cochrane	
23	Natal	
23	Warrior	
22¼	Devonshire	
22¼	Antrim	
22¼	Argyll	10,850
22¼	Carnarvon	
22¼	Hampshire	
22¼	Roxburgh	
23	Monmouth	
23	Kent	
23	Essex	
23	Berwick	
23	Cornwall	9,800
23	Cumberland	
23	Donegal	
23	Lancaster	
23	Suffolk	
23	Drake	
23	Good Hope	14,100
23	King Alfred	
23	Leviathan	
21	Bacchante	
21	Euryalus	12,000
21	Sutlej	
20¼	Amphitrite	11,000
20¼	Argonaut	
20¼	Europa	11,000
20¼	Niobe	
	35 ships	414,600

GERMANY.

Speed.	Name.	Displacement.
knots.		tons
23	Blücher	15,550
22½	Scharnhorst	11,420
22½	Gneisenau	
21	Roon	9,350
21	Yorck	
20½	Prinz Adalbert	8 858
20½	Friedrich Karl	
20½	Prinz Heinrich	8,759
19	Fürst Bismarck	10,570
	9 ships	94,135

RUSSIA

Speed.	Name.	Displacement.
21	Rurik	15,170
22	Adm. Makaroff	
21	Bayan	7,900
21	Pallada	
20	Gromoboi	13,220
20	Rossia	12,130
	6 ships	64 220

AUSTRIA-HUNGARY.

Speed.	Name.	Displacement.
knots		tons
22	St. Georg	7,185
	1 ship	7 185

FRANCE

Speed.	Name.	Displacement.
23	Edgard Quinet	13 780
23	Waldeck-Rousseau	
23	Ernest Rénan	13 427
23	Jules Michelet	12,370
22	Leon Gambetta	
22	Jules Ferry	12 351
22	Victor Hugo	
21	Condé	
21	Gloire	
21	Marseillaise	9,856
21	Admiral Aube	
21	Gueydon	
21	Montcalm	9,367
21	Dupetit Thouars	
21	Jeanne d'Arc	11 092
21	Desaix	
21	Dupleix	7,578
21	Kleber	
	18 ships	191,761

TABLE V.—LIGHT CRUISERS.

GREAT BRITAIN.

Speed.	Name.	Displacement
knots		tons
30	*Calliope*	
30	*Conquest*	
30	*Cordelia*†	
30	*Carysfort*	3,800
30	*Cleopatra*	
30	*Comus*	
30	*Caroline*†	
30	*Champion*	
30	Arethusa	
30	Aurora	
30	Galatea	
30	Inconstant	3,750
30	Penelope	
30	Phaeton	
30	Royalist	
30	Undaunted	
26	Birmingham	
26	Lowestoft	5,400
26	Nottingham	
26	*Brisbane*	
25½	Chatham	
25½	Dublin	
25½	Southampton	5,400
25½	Melbourne	
25½	Sydney	
24¾	Dartmouth	
24¾	Falmouth	5,250
24¾	Weymouth	
24¾	Yarmouth	
25	Bristol	
25	Glasgow	
25	Gloucester	4,800
25	Liverpool	
25	Newcastle	
19¾	Crescent	7,700
20	Edgar	7,350
20	Endymion	7,350
19¾	Gibraltar	7,700
20	Grafton	7,350
20	Hawke	7,350
19¾	Royal Arthur	7,700
20	Theseus	7,350
19½	Diana	
19½	Dido	
19½	Doris	5,600
19½	Eclipse	
19½	Isis	
19½	Juno	
19½	Minerva	5,600
19½	Talbot	
19½	Venus	
19	Furious	5,750
19	Vindictive	
20	Hermes	
20	Highflyer	5,600
20	Hyacinth	
21	Challenger	5,880
21	Encounter	
[illegible]	Fearless	3,440
[illegible]	Active	
[illegible]	Blonde	3,350
[illegible]	Blanche	
[illegible]	Bellona	3,300
[illegible]	Boadicea	
[illegible]	Amethyst	
[illegible]	Diamond	3,000
[illegible]	Sapphire	
[illegible]	Topaze	
19½	Astræa	
19½	Charybdis	4,360
19½	Fox	
19½	Hermione	
20	Sappho	3,400
19	Philomel	2,575
[illegible]	Pelorus	
[illegible]	[illegible]	2,135
[illegible]	[illegible]	
[illegible]	[illegible]	2,200
[illegible]	[illegible]	
[illegible]	[illegible]	2,670
[illegible]	[illegible]	
[illegible]	[illegible]	2,850
[illegible]	[illegible]	
[illegible]	[illegible]	2,040
[illegible]	[illegible]	
[illegible]	[illegible]	2,895
[illegible]	[illegible]	
	[illegible] ships	[illegible]

GERMANY.

Speed.	Name.	Displacement.
knots.		tons.
27½	*Ers. Gazelle*	
27½	*Ers. Niobe*	
27½	*Ers. Gefion*†	5,000
27½	*Ers. Hela*†	
27½	*Regensburg**	
27½	*Graudenz**	
27	Karlsruhe	4,820
27	Rostock	
27	Stralsund	4,500
27	Strassburg	
21	Kaiserin Augusta	5,956
19½	Freya	
19½	Hertha	5,569
19½	Victoria Luise	
19½	Hansa	5,701
19½	Vineta	
27	Augsburg	4,280
25½	Kolberg	4,234
24½	Emden	3,544
24½	Dresden	
23½	Stuttgart	
23½	Nurnberg	3,396
23½	Stettin	
23	Konigsberg	3,346
23	Bremen	
23	Hamburg	
23	Berlin	
23	Munchen	3,200
23	Lubeck	
23	Leipzig	
23	Danzig	
21½	Frauenlob	
21½	Arcona	2,657
21½	Undine	
21	Medusa	
21	Nymphe	2,618
21	Amazone	
21½	Thetis	
21	Gazelle	2,603
21	Niobe	
	40 ships	159 070

RUSSIA

Speed.	Name.	Displacement.
27½	*Admiral Grieg*	
27½	*Svietlana*	
27½	*Admiral Boutakoff*	7,600
27½	*Admiral Spiridoff*	
27½	*Admiral Lazareff*	
27½	*Admiral Nakhimoff*	
20	Aurora	6,731
23	Askold	5,905
23	Bogatyr	
23	Kagul	6,675
23	Pamyat Merkuria	
23	Oleg	
27½	*Admiral Nevelskoi*	4,300
27½	*Mouravieff Amoursky*	
19	Almaz	3,285
23	Jemtchug	3,106
	16 ships	99,997

AUSTRIA-HUNGARY

Speed	Name	Displacement
knots		tons
19	K. Maria Theresia	5 187
20½	Karl VI	6,151
26	Admiral Spaun	
27	*Saida**	3,500
27	*Helgoland**	
27	*Novara*†	
20	Aspern	2,362
20	Szigetvar	2,313
20	Zenta	2,264
	9 ships	32 277

FRANCE

Speed	Name	Displacement
19	D'Entrecasteaux	7,995
23	Guichen	8,151
23	Châteaurenault	7,898
18	Bruix	4,735
19	Pothuau	5 374
23	Jurien de la Gravière	5,595
20	Lavoisier	2,285
20½	D'Estrées	2,421
19½	Friant	3,882
19	Descartes	3,970
19	Cassard	3,890
19	Du Chayla	3 890
	12 ships	60,086

* Completed in three (3) months. † Completed in six (6) months.



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Royal British field artillery in action.



Photograph by Paul Thompson.

A French bicycle corps with its collapsible bicycles.



Removing Rubens' masterpiece, "Assumption of the Virgin," from Antwerp Cathedral, to be hidden.



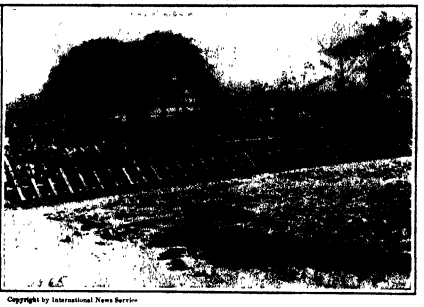
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All that remains of Termonde's beautiful gateway after the German bombardment.



Photograph by Paul Thompson

German infantry in a natural trench.



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An obstacle outside Paris in anticipation of a German advance.



Germans constructing temporary bridge.

PICTURES FROM THE FRONT

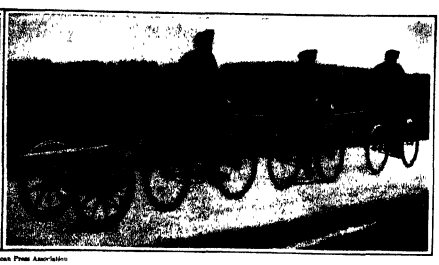


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German Fleet Steaming in Battle Formation



Belgian soldiers digging trenches on the outskirts of Malines.



A British cyclist machine gun battery.

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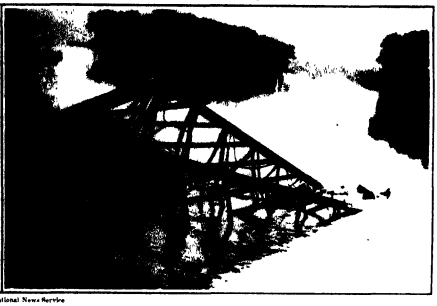
Dummies used during maneuvers by German army for rifle practice.



A German bomb-proof.

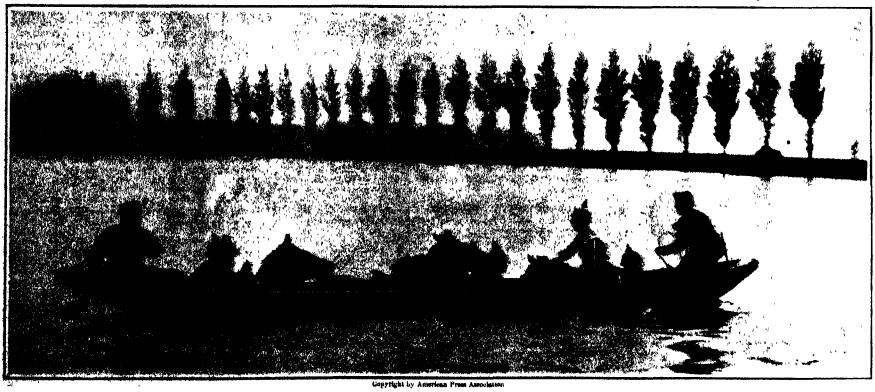


A French motorcar equipped with a machine gun.



Bridge at Argentau, blown up by the Belgians to impede the Germans.

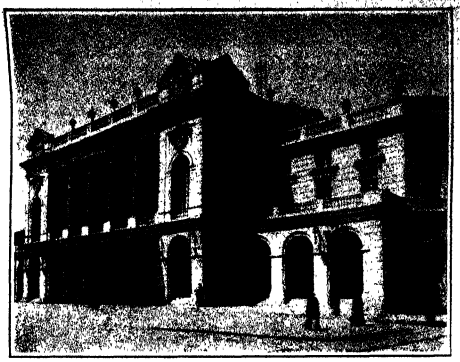
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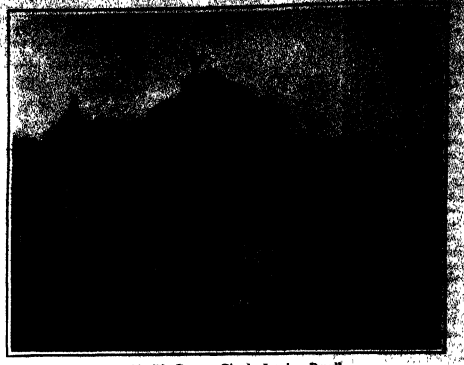
German cavalry crossing a stream. The horses propel the boat.

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PICTURES FROM THE FRONT



The Municipal Theater of Santiago, Chile.



Avenida Rio Branco, Rio de Janeiro, Brazil.

Our Latin American Opportunity

An El Dorado for Our Business Men

By John Barrett, Director General of the Pan-American Union, Formerly U. S. Minister to Siam, Argentina, Panama and Colombia.

IF Latin America will be approached by all those who wish to engage in its material evolution in the same way that the opportunities in the United States and Canada have been approached, with the corresponding victories and defeats, successes and disappointments, there is no reason why there should not be a development during the next ten years in these southern nations which will bring not only greatly added prosperity to their peoples, but satisfactory rewards to the engineers and investors of the United States and Europe who co-operate in the right spirit with them.

For many years the Pan American Union, which is the international organization of the twenty-one independent American republics, maintained in Washington for the development of commerce, intercourse, friendship and peace among them all, has been carrying on without ceasing a propaganda to educate the people of the United States regarding the Latin American countries, and, in turn, to inform Latin America concerning this country. There are no better instrumentalities for the advancement of both confidence and commerce, of good understanding and trade, than the spread of useful and reliable information about each country among all the others. The better they know each other, their resources, their potentialities and their peoples, the more will they be desirous of promoting exchange of commerce and always preserving peace and prosperity throughout the Western Hemisphere. In response to this constant agitation of the Pan American Union there has been a gradual growth of interest in each American republic about the others, and especially in the United States about its sister American nations, which has been gratifying and encouraging.

Effect of the War on Latin America.

It has remained, however, for a great misfortune in the relations of nations to center an extraordinary and special interest in Latin America. The European war, which is perhaps the most deplored combat in the history of the world, has unexpectedly emphasized to the Western Hemisphere the present onward movement and the future possibilities of each of the Latin American countries, not only in commerce, but in everything that pertains to material, economic and social advancement. Although a larger number than is generally appreciated of our manufacturers, exporters, importers, bankers, travelers, and students of the world's progress had already developed close acquaintance with Latin America, which was bringing splendid results, still the great majority of people in the United States required some extraordinary event like the European war to turn their attention to the southern republics.

To get a proper appreciation of Latin America certain fundamental facts must be borne in mind. "Latin America" is a comprehensive term. It includes all of the countries from the Rio Grande and Straits of Key West south to the Straits of Magellan. "Spanish America," a term often misused, does not include Brazil, which has the largest area and population of any country in Latin America. It also excludes Haiti, which though small, is potential in the commerce and development of the lands of the Caribbean Sea. In discussing Latin America, however, the average man in the United States must not make the cardinal error of overlooking the individuality of each one of these countries. If he is speaking of Argentina alone, he must not call that a Latin American land or its population "Latin Americans." He should refer to the country invariably as "Argentina" and to the people as "Argentines." In mentioning the Brazilians they should not be called "Portuguese Americans," but "Brazilians." In considering Chile, it should not be described as a Spanish American or South American country of the West Coast, but distinctively as "Chile," and it should be remembered that the "Chilenos" are just as proud of being called by that name as peoples of the lands of Europe are anxious to be called "Englishmen," "Frenchmen," "Germans," etc.

There has been too much of a tendency in the past to call all the peoples south of the United States "Latin Americans," as if they all had the same history, the same characteristics and the same possibilities! The truth is that almost every one of these twenty countries has its individual characteristics as distinctive as those of the United States. When the commercial man, the engineer or the traveler visits these countries, he should always bear this fact in mind if he would win the appreciation, interest and confidence of the peoples with whom he is attempting to do business or associate. Closely allied to this thought is the necessity of the avoidance by all men from the United States, when visiting the southern countries and peoples, of an air of patronage, or of suggestion that these lands are in any way behind the United States in progress or dependent upon the United States for their prosperity and development. If any such suggestion is to be made, it should come from their peoples rather than those of this country.

Latin America in North America.

In studying Latin America it also should be noted at the very outset that there are signal geographical differences with corresponding segregation of interests, of commerce, and of opportunities. The average superficial observer should not forget that there are ten Latin American countries which are not in South America, but practically a portion of the North American continent. Mexico, the five Central American countries of Guatemala, Salvador, Honduras, Nicaragua, and Costa Rica, together with Panama, Cuba, the Dominican Republic, and Haiti, are distinctively, from a geographical and commercial standpoint, North American. The commercial and financial transactions of all these ten countries are greater with the United States than they are with Europe. In this same group also could be classed two of the countries of the South American continent; namely, Colombia and Venezuela. Both of these countries, for example, exchange more products with the United States than they do with any individual European country. In considering, therefore, the subdivisions of Latin America, there might be placed in one division these twelve countries just named, not only because of their commercial and financial relationship, but because of the fact that they are nearer by routes of transportation to the principal ports of the United States than they are to the principal commercial entrepôts of Europe. Colombia and Venezuela, inasmuch as they are in South America proper, seem more remote than they really are. The distance from the most northern points of those two countries to Key West is less than the distance from New York city to Kansas City.

These lands that border on the Gulf of Mexico and the Caribbean Sea present to the United States vast fields of commercial and financial activity. Some of them have already made remarkable progress and are conducting a rapidly growing trade, but the majority of them need an abundance of money to be invested in all kinds of material enterprises in order that they may enter upon a great progressive advancement. The so-called difficulties of revolutions and instability of government must not be exaggerated to the extent that there will not be a realization of their enormous natural resources. Although unfortunate conditions may have obtained, for instance, for some time in Mexico and in one or two of the Central American and other Caribbean lands, it is the firm belief of those of us who have studied the field for long years that these unfortunate conditions are simply the darkness before the dawn, and that during the next ten years there is going to be a new material and commercial era in all of them which will astonish the world. These twelve countries represent a combined population of thirty millions, and they already conduct an annual foreign trade valued at approximately $700,000,000. In this trade the United States is increasing its transactions much faster than is any country of Europe, notwithstanding a prevailing impression to the contrary. It is, therefore, logical that if these twelve countries or their contributory coasts are conducting this foreign business just as the Canal is opening, they should in another ten years increase it to $1,000,000,000 and more, with corresponding advantage to them and the United States.

The Influence of the Panama Canal.

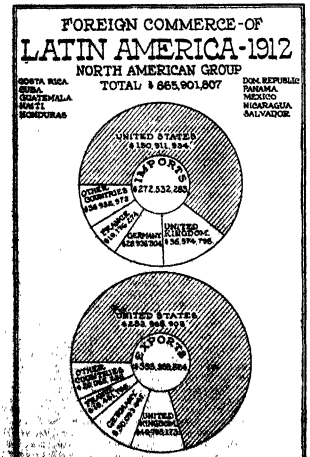
The significance and value of the Panama Canal must always take into consideration these twelve countries, which, as it were, are on the way to the Canal. Usually in discussing the Panama Canal there is thought only of what is beyond the Canal in the Pacific Ocean. If a bridge is built across a great river connecting two important cities or localities, the neighborhood approaching the bridge benefits and is built up as well as the neighborhood beyond it. The Panama Canal is a mighty water bridge between the Atlantic and the Pacific, and it will benefit the Latin American countries tributary to the Atlantic just as much as it will the Latin American countries tributary to the Pacific Coasts. Almost every part of this group of countries bordering on the Caribbean and Gulf has commenced to feel the influence of the new commerce and travel which the Panama Canal is helping to develop. By the railroads that they have been building across narrow necks of land, as we have, and placed upon 3, 4, and 5 steamship lines. They are all so near to the Atlantic and Pacific coasts of the United States that to-day a considerable portion

[illegible] Panama Canal, [illegible] and [illegible] Latin America to [illegible] commerce, investment, construc- [illegible], etc., in its western coast, now reached through the Panama Canal, which extends approximately, San Diego, California, in a south- [illegible] direction 8,000 miles to the Chilean port of [illegible] on the Straits of Magellan. That this [illegible] coast line, which could only be approached [illegible] opening of the Panama Canal by vessels [illegible] the Gulf and Atlantic ports of the United [illegible] a journey of 30 to 50 days, is most resource- [illegible] essential is proved by the fact that its coun- [illegible] in their entirety or in their sections tribu- [illegible] Pacific, have a population of twenty millions [illegible] been conducting, without the Canal, an annual [illegible] commerce valued in excess of $600,000,000. If [illegible] were able to conduct this trade in their former [illegible] it is safe to predict that they will build it up [illegible],000,000 within the next ten years. While [illegible] the United States was at a great disadvantage [illegible] commerce, it should now, by using the Canal, [illegible] satisfactory share of it.

The West Coast of Latin America.

It is not possible within the limits of this article to analyze carefully the commercial, material, economic, and engineering possibilities of each one of the twelve countries or their coast lines tributary to the Pacific, but certain interesting conditions and potentialities should be emphasized. From long familiarity with these countries, their geographical formation and their resources, I do not share the contention of many persons that they do not offer a specially inviting field for capital and commerce. It is to be admitted that the average traveler who goes up and down the West Coast of Latin America to-day sees much that is forbidding and discouraging in the vast extent of unwatered and unforested plateaus and mountains. This was true, however, of those who first looked upon the shores of much of the Pacific Coast of the United States. There has been such an extraordinary development in the arid portions of California, Oregon, and Washington through irrigation, the harnessing of water power, the building of railroads and the employment of modern methods of agriculture and industry, that there is good reason to believe that the corresponding sections of Mexico, Central America, Colombia, Ecuador, and Peru, Bolivia, and Chile will experience a like progress and prosperity when similar methods have been employed in them.

What already, moreover, has been done and is being done in such a remarkable land as Chile is strong evi-



The trade of the Latin North American republics.

Alaska; and it has the same diversity of climate and resources! Covering an area nearly equal to that of California, Oregon, and Washington combined, or more than that of Texas, it is improving its ports and building railroads from them into the interior, which, in turn, are being connected by a great longitudinal line. All this construction is transforming its economic development. From the forested and fertile areas of the south to the arid nitrate sections of the north, Chile is entering upon a new life which must receive a fresh impulse from the opening and use of the Canal.

The vast interior country of Bolivia, with an area double that of the State of Texas; the long reach of Peru, with a coast line on the Pacific equal to the whole Atlantic Coast line of the United States from Maine to Georgia; the lesser, but resourceful area of Ecuador, all tributary to the Pacific; and the western coast of Colombia—the only South American land which has an extensive coast on both the Atlantic and Pacific—and its sister land of Venezuela likewise, through the construction of railways, the exploitation of their mineral resources and the development of agriculture by irrigation, form an inviting field of opportunity.

In considering the future of the western Latin American countries, the towering Andes should be classed as a favorable instead of a frowning feature in material, industrial and agricultural advancement. Down from their sides in some sections, though not in all, come rivers which have been harnessed or must be harnessed for irrigation, electrical power and other utilities. Though in the main the Andes present a front to the Pacific which is uninviting, they contain in the interior numberless valleys and numerous plateaus, which only await connection with the coast by railways to become the home of considerable populations and the scenes of industrial and agricultural prosperity.

The Eastern South American Republics.

Turning now from the northern and the western portion of Latin America, we consider the vast area, the economic and commercial conditions and the potentialities of the countries of South America tributary to the southeastern Atlantic; namely, Brazil, Uruguay, Paraguay, and Argentina. Here we have a population of approximately thirty millions, and a foreign commerce, in normal conditions, amounting annually to $1,500,000,000, and it is no exaggeration to predict that, when peace is again restored in Europe and these countries have recovered from the blighting influence of the war, this trade will commence a development which within a decade, or at the outside within twenty years, will double itself. Despite the fact that in one or two of these countries there was a financial depression prior to the war, they have such enormous natural resources and capacity of production that they must go forward even beyond present realization. The fact alone that Brazil has an area greater than that of the connected area of the United States, with every variety of climate and product, with navigable waterways more extensive than those enjoyed by any other nation, and with a coast line on the Atlantic nearly equal to that of the United States on the Atlantic and Pacific combined, is evidence in itself of her potentialities. Although it may be true that the 20,000 miles of navigable waters in the valley of the Amazon are largely in the tropical belt, the new life which is coming to the tropics as a result of the experiments already successfully demonstrated in Panama, along the Caribbean, in India, and in other tropical sections, proves beyond question that in reasonable time the Amazonian and tropical section of Brazil will become the scene of an economic evolution and the home of populations not dreamed of by the average observer. If, therefore, the investors, the capitalists, the engineers, and the advance agents of commerce of the United States realize now this possibility and get ready to co-operate with the Brazilians in this development, they cannot fail to bring great and good results eventually alike to the United States and Brazil.

Uruguay and Paraguay are small in area compared to Brazil and Argentina, but they make up for this in present progress and future potentialities. Uruguay occupies a position of importance on the South American map not unlike that of Holland and Belgium on the map of Europe. The foreign commerce it already conducts amounts to nearly $100,000,000 annually; and its progressive capital, Montevideo, which has recently spent $10,000,000 on harbor improvements, convinces any observer of Uruguay's importance and wealth. Paraguay has suffered in the past from comparative isolation, but the world is now realizing that it is a land of great agricultural possibilities.

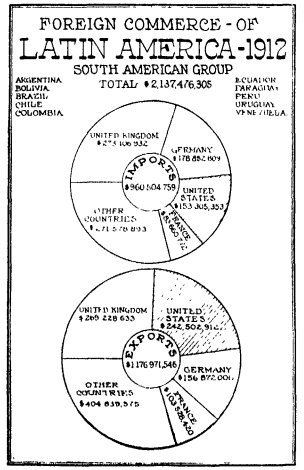
The Progressive Position of Argentina.

Reserving for the last, but not as least, consideration of the Argentine Republic, we discuss a country which is one of the most interesting and inviting in the wide world. Located almost entirely in the south temperate zone, having a greater reach in its connected area from north to south than the United States, covering more square miles than that section of the United States east of the Mississippi River, and conducting an annual foreign commerce valued in normal times at nearly $000,000,000, it certainly is deserving of the closest study. Although it has been characterized with the construction of a railroad system and an agricultural development more extraordinary than that of any other country in the Western Hemisphere, except the United States, it has only just begun to enter upon a period of power and position in the family of nations which must grow in influence and wealth as the years go by. While the central section tributary to the mouth of the River Plate system has reached an extraordinary prosperity, large sections of the northwest and southwest correspond in their possibilities to the similar sections of the United States and are worthy of the closest inspection by the constructive engineers, capitalists, commercial and financial interests of the United States. Buenos Aires, the capital of Argentina, is typical of the land as a whole. This city, with its population of 1,600,000, to-day ranks as the third city in the Western Hemisphere, coming after New York and Chicago; the second Latin city of the world, ranking after Paris, and the largest city south of the Equator. When I was minister there ten years ago, I frequently counted along its extensive system of docks and wharves a hundred merchant vessels loading and unloading. The Argentines themselves are a genial and progressive people, and recognize the value and usefulness of the co-operation of legitimate foreign interests.

In concluding this survey of a portion of the Western Hemisphere which extends from Mexico and Cuba south to Argentina and Chile and covers an area of nine millions of square miles, or three times that of the United States proper, which maintains a population of seventy-five millions that is increasing more rapidly by reproduction than the population of the United States, which in the future may prove even a greater field for immigration than has this country, and which already buys and sells in trade with the foreign world products valued at the immense total of nearly $3,000,000,000, we must remember that the most important factor of all in its relations with the United States is the practical application of reciprocity of interests. The great material interests of the United States must not only consider their own opportunity in these countries, but the opportunity for these countries in the United States! Our business men must endeavor to increase the market for South American products in the United States as well as the market in South America for the products of the United States.

A Final Word of Caution.

A word of caution, however, must here be emphasized. It is a mistake to assume that, on account of the war in Europe, there is to be an immediate and enormous



The trade of the South American republics.

profit in Latin America for the commercial, financial, industrial, and engineering interests of the United States. It will require considerable time for a readjustment of conditions that will permit of such possibilities.

Opinion from Prominent Business Men on Our Trade Opportunity

An Unprofitable Experiment

My company's experience in its line proved it unprofitable in the South American trade against the competition of European manufacturers, whose facilities in costs of production, shipment, and banking were such as to highly discourage our efforts.

SIDNEY MASON,
Philadelphia, Pa. *President Welsbach Company.*

High Standards are Necessary to Hold Markets

If a foothold is once secured (and it does seem under present conditions as if there should be no difficulty in getting such trade as would be satisfactory from the point of view of terms of settlement, etc.), the following two factors would be of great importance.

The manufacturers of the United States have finally discovered that, in order to hold *any* market, their product must be of the very highest standard and so maintained.

They have also learned to study the peculiar requirements of any market, and I believe will thus be able not only to supply the very highest grade of product, but one which, as a result of such study, will be best adapted for the country in which it is sold

A. J. POSTUM,
Niagara Falls, N. Y. *The Shredded Wheat Company.*

Give the South American What He Wants

Before the American manufacturer can hope to compete for the world's trade in foreign markets, he must study the conditions and the wants of the various countries and the people with whom he seeks to do business No manufacturer who confines his business to America would continue to make last year's styles to sell to this year's trade, but some manufacturers seem to think that, because the style or character of an article suits the American trade, it is good enough for the foreigner. Until he is ready to treat the foreigner with the same consideration that he treats his home trade, especially when he attempts to compete with others who do show that consideration, he is going to be at a disadvantage.

In other words, no matter where you sell your goods, you must give the buyer what he wants and in the way in which he wants it. If you study the conditions abroad with the same care that you study those at home, it will be found that there will be an ever-growing foreign market for the products of American manufacture. J. W. EARLE,
New York. *President Remington Typewriter Company.*

Study Your Market

First, learn the people, their characteristics, their methods, and, being properly introduced and accredited, observe their conventionalities

Second, give them the goods they want, as they want them, and in quality as represented.

Third, learn how to ship, ship as instructed and with particular regard to handling and moving on the part of the customer on reaching destination

Fourth, and a prerequisite, good banking and exchange facilities.

Fifth, and a prerequisite, ships to carry the goods.

The fourth and fifth answers are really the most important, and can be obtained most readily by agitation on the part of important financial, commercial, and manufacturing associations

The new Federal Reserve Act helps in the matter of banking facilities, and it looks as though recent events were going to facilitate the shipping

A permanent customer is one who is properly used and who is pleased with his goods FRED'K S. FISH,
President The Studebaker Corporation
South Bend, Ind

A Conservative Policy Advocated

In our industry, which is a specialised one, there are competing companies established in England, France, Germany, Austria, Russia and Japan, and owing to our disadvantage in high cost of labor, the fact that many of our raw materials are imported and that all our charges, including overhead costs, are so much larger than those of the foreign manufacturers, we are unable to compete with them as to costs, in their own or other countries. Even in the United States, under the present reduced tariff, these manufacturers are enabled to undersell us in many lines, particularly those in which labor plays an important part.

Under such circumstances, even though for a time the foreign output is curtailed, it would not be a prudent policy to invest large amounts of capital in increasing plants and establishing markets with the certainty that after the lapse of a definite, and not very long period, the old conditions of comparative costs, etc., would be again restored.

Regarding the problem as it affects business generally, I do not profess to be well informed No doubt each class of industry has its own problems to meet but I think that those who are not, in some way, favored by local conditions, will be in the same position as ourselves M. C. LEFFERTS,
New York *President The Celluloid Company*

Difficulties of Obtaining South American Trade

Outside of staples, which conform to world-wide standards, American products can only successfully be introduced into foreign markets by the manufacturer who studies those markets on the ground or through competent representatives, and who is willing to incur the trouble and expense involved in conforming his products to the needs, customs, and preferences of the markets he seeks to enter. If catalogues are required, they must be printed in the language of the country In the case of minor products, at least, stocks should be carried at the large commercial centers, or else liberal terms of payment should be extended on factory orders. Where traveling salesmen are employed, it is indispensable that they should speak the language of the country. If customers are permitted to settle through some local and convenient channel and in local funds, business, especially with houses of the smaller class, will greatly be aided and encouraged. HENRY R TOWNE,
President The Yale & Towne Manufacturing Company.
New York.

First Hand Knowledge is Needed.

American export trade can be increased permanently in only one way, viz., by meeting European competition as to price and terms. We may increase export sales temporarily in many lines because of the shortage of European goods, but trade can only be retained by meeting competition.

Almost all South American and Eastern trade is done on long time. Credits are extended for a year or more. This is entirely contrary to the American way of doing business, and the average American business man will not consent to it providing he can sell his goods in his own country on short time.

In most lines of goods manufactured almost entirely by machinery, competition as to price is comparatively easy owing to improved and perfected methods of manufacture in American factories, but where human labor is the principal factor in manufacture, it is hard to compete in price with European goods because of the lower average wage scale in Europe.

In order to gain a permanent foothold in the export trade, there must be a very careful study of the tastes and demands of the people of South America and the East. This careful previous preparation is not characteristic of the average American business man. It will be necessary, however, if we wish to retain a large export trade.

CHARLES H. HULBURD,
Chicago, Ill. *President National Watch Company.*

Foreign Trade Must Be Systematically Sought

It would seem that the opportunity was ripe for the manufacturers in this country to secure quite a portion, at least, of the trade of the South American states that has heretofore gone to continental Europe.

But in order to accomplish this, it will be very necessary for the American manufacturers to "go after" the business in a systematic way and send their representatives to visit the merchants in those states, and such representatives should be able to speak the Spanish language and thus come in personal contact with those whose trade they are seeking.

There seems to be a feeling on the part of some of the manufacturers in this country that there will be in the near future a great influx of South American buyers in this market seeking the various classes of merchandise which are adapted for their use, and ready to take them as they are put up for our home market. This, I think, is a mistake, and while there may be a few such buyers, they will be comparatively limited outside, perhaps, of a few lines.

The American manufacturer, if he wishes to obtain and hold any of this trade, must meet the requirements made by the buyers and not try to force them to adopt the American methods, either in the makeup or packing of their goods

The Merchants' Association has a fully equipped Bureau of Foreign Trade, and is prepared to furnish all the information possible to any of its members, or the public at large, who are seeking for a market for their goods in South America.

W. A. MARBLE,
President The Merchants' Association of New York.

The Essential Factors

The present war in Europe has furnished an opportunity in trade and commerce which, if grasped by our bankers and merchants, will mean more to us than it is now easy to realize. In order to take advantage of this opportunity and to secure permanently a foothold in foreign markets we must ascertain those factors which are essential to success.

1 We must have an exchange market.
2. A merchant marine.
3. Our merchants and manufacturers must have a knowledge of the needs of the different markets and be willing to meet them.

Sergius Sasonoff, the Russian Foreign Minister, has just made the following statement. "It is the country which foresees the situation commercially in Russia that will reap the enormous benefits that the Russian markets now offer. It is not enough that merchants and manufacturers should offer their goods here. Experts should be sent here now, even in the war is still in progress, to study and examine the wants of our country Our duties, our manner of doing business, and our present and future wants and growing demands should be studied scientifically."

What Mr Sasonoff says as to Russia is equally true of the other markets of the world. It may be interesting to know that the Merchants' Association of New York has an industrial bureau, which stands ready to assist the merchants and manufacturers of this country, by supplying them with such all the information that is available regarding foreign markets WM. FELLOWS MORGAN,
President Brooklyn Bridge Freezing and Cold Storage Co.
New York

Cheap Goods Are a Necessity

We have tried out many markets in our line of goods and find that we cannot make the ware cheap enough for us to secure any considerable business.

Of course this does not apply to every other line, but we have spent a good deal of money endeavoring to exploit export business. We had a warehouse at one time and carried a large stock in London, but it was an unprofitable venture after a full trial, and we gave it up. We also had a showroom in Paris and have done some trade, but we finally abandoned that. We have been doing some business in Germany and Russia on special lines of goods, but on the ordinary staple run of goods it is impossible for us to compete with English and other foreign manufacturers in our line.

As to South America, we have an agent at the present time, not exclusively, however, but one who thoroughly understands our business, in the Argentine and Chili. We sell some of the more expensive lines of our goods there, but the ordinary run of ware, our staples, which constitutes probably 60 per cent of the business, cannot be sold there because of the fact that the English manufacturers can undersell us.

Furthermore, naturally we have not had the banking facilities or the shipping facilities there, which has put us at a still further disadvantage. Now that the banking facilities will in a short time be secured, we have no doubt that with some direct shipping facilities we might be able to do more in that country. We have word from our agent that things are a little too unsettled there to endeavor to press for anything at the present time, but that he is looking out for the conditions, and just as soon as there is a chance for improvement we will be informed.

We have not neglected the opportunities in Europe, but retain places for export business, but we pay good wages to men, far more than are paid in other countries, and [illegible] equal expense in our business to the wage scale, as we [illegible] or no machinery.

As I stated in the beginning, you can see [illegible] this letter you please, because I have not undertaken [illegible] oralise on the question, leaving that to others, but [illegible] you our experience in our efforts to secure a [illegible] business. E. E. CARR,
President and General Manager The Stanton Pottery Co.
Trenton, N. J.

A Study of Foreign Banking and [illegible] Methods Essential

I share the apparent view of the majority, that the [illegible] is most opportune for this endeavor. It is my [illegible] that our banks must have foreign branches and be in a [illegible] to extend credit to our foreign customers, since the [illegible] unaccustomed to paying bills promptly. Our manufacturers must learn the kind of articles desired and the manner in which they must be packed, to suit the requirements of foreign customers. It has been said, and I think with a [illegible] of truth, that the willingness on the part of the German [illegible] do this, has enabled them to compete successfully with [illegible] English manufacturers, who prefer to retain their own standards. Our consuls should be capable of rendering the same valuable service as the English and Germans, and, of course, we must have a good marine service to the various countries with which we trade. Even should we be afforded the [illegible] banking and transportation facilities that England and [illegible] many have heretofore enjoyed, we must, by manufacturing skill, coupled with large production, be able to offset the higher cost of labor in this country as compared with those countries, and what seems to me a great essential, is to prove by our acts that we maintain a standard of quality for our products. Unfortunately, we do not have this reputation at present, and while I hope it is not well founded, the impression still exists abroad. R. L. PATTERSON,
President American Machine and Foundry Company.
New York.

A Trade Commission to Study Export Trade

There is no question in my mind that the present is a particularly appropriate time for the United States to secure a larger portion of South American, Russian and other export trade, the South American trade alone amounting to more than seven hundred and eighty millions. The war is only an incident which should act as a reminder of our negligence in the past. The four hundred odd millions which we have spent on the Panama Canal gives us tremendous advantage. Despite this and other natural advantages, we nevertheless cannot gain our object without great effort.

In this letter I do not care to discuss in detail the various elements that are needed to secure our portion of the world trade, such as transportation, financial arrangements, and the question of sending efficient salesmen to the spot to ascertain the demands of the country. I simply wish to point out in a general way my views as to how this business can be secured.

We have been held back from getting our share of the world trade, and we will be held back in the future even more because this export trade cannot be obtained by the middle or small class merchant who wants to export, as he cannot afford to take from his capital account the money necessary to obtain data as to how to get this business. The larger corporations can afford to make these expenditures But these corporations are frequently deterred from developing these outside resources, as they fear adverse legislation that would probably arise when it is realized to how great an extent these corporations control business. It is quite true that our legislators have generally stated that it is not their intention to interfere with big business *per se.* Nevertheless it is big business that has in the past been attacked.

My suggestion, therefore, is that when the Trade Commission which is to have supervision of corporations is appointed, it should be allowed a reasonable sum each year, so that it can maintain a special department for the purpose of investigating and making recommendations how best the export business to foreign countries can be secured. The Commission will have at its disposal all necessary information gathered by our Consuls who can keep the Commission informed where business can be had, and all details as to the various classes of merchandise wanted, prices, quantities, and other information of importance The Commission could make recommendations to Congress, after careful study, as to what is necessary in the way of transportation. Congress, if it sees fit, can and probably would do the needful in that direction It would be necessary to provide proper financial arrangements. The Commission could consult with the Federal Reserve Board, which would be able to make recommendations to the Commission, or to Congress direct, as to what is necessary, and in this way financial difficulties could be overcome. In fact, all details could be obtained and worked out through the agents of the United States and distributed at a central bureau, or through Chamber of Commerce to the merchants throughout the country.

The central idea of my suggestion is that the Trade Commission should do for business much the *same as* the Agricultural Department has been and is doing for the farmers of the country. It is evident, as conditions are at present, that the smaller merchant cannot develop the opportunity of enlarging our export trade which is now before us. Certainly the present generation would get no benefit therefrom. The Commission should be impressed with the importance of the fact that it is not to be a body appointed by Congress for the purpose of curtailing business, but, quite to the contrary, for the purpose of developing business and getting greater opportunities for all.

The great importance of this Commission will be seen as a finance, as it will probably interfere with real big business, which will result in a loss of business to the country, but if the export business is developed, as it can be done, in a very large way, this new business will many, many times make up the loss that may follow the curtailment of real big business which may be ordered by the Commission because business may regard same as a monopoly. DARIUS [illegible],
President of the American Smelting and Refining Company.
New York.

...Opportunity and Its Cultivation

...ers of the North American manufacturers' opportunity in South America compel us to put up several logical questions.

(1) *Is there any opportunity?*

(2) *If so, how great is this opportunity?*

(3) *Is the opportunity to be cultivated?*

(1) Very likely the first question is superfluous. Very few persons of general responsibility that we have an opportunity in South America sufficient to warrant serious attention to the matter. It is a general idea at the present time. The Germans, the French, and the British discovered an opportunity there years ago, and they have consistently and persistently been increasing it ever since, while we Americans have been so busy developing our home market that we have kept aloof; but the opportunity is still there, and it is no respecter of nations. The tremendous area of the Continent, in a single one of its fifteen countries—and that not the largest—might be parceled out among Germany, France, Great Britain, Italy, and Switzerland, with room for Germany and Great Britain over again; and the sentiment populated less than half as densely as North America, makes it evident that an enormous consumption of manufactured articles must take place before South America's development will have progressed to any extent.

We have always known these things more or less vaguely, and the European war has forced them on our attention very forcibly, and has made it possible to make a profit, instead of loss, while building a trade. Demand must be supplied. A certain amount of this fruit would fall into the laps of American manufacturers, in the shape of orders, even if we were not prepared to export trade. The longer the war lasts, the longer the fruit will continue to fall, even if we do not see fit to get busy and climb the tree. And some of this business would be permanent, for the Latin-American is loath to change his business relations, once they are established. But the broad-gage manufacturer should not be satisfied with such a happy-go-lucky indux of business. Otherwise he would do well to avoid any permanent plant extensions or other investments of capital to care for a trade which, after a few years at most, will again be keenly striven for by European interests.

(2) *How great is the opportunity?* I would answer, "As great as the American nation is willing to conceive it in our plans and preparations." The limitation will be of the sending, not at the receiving end. Failure to recognize this has, I think, caused many to overestimate their ability to go down and do great things in South America. Why this is so may be realised by contrasting our own lack of preparation with the sagacity that has been displayed in foreign trade-building by other nations. The European merchant is not "to the order," but foreign traders are made, not born. Germany has been making them during the past two generations, until she has developed a whole race of them. Encouraged in every way by the imperial government, these specialized traders have methodically been campaigning for South American business for nearly half a century. They have evolved an educational system, a shipping system and a banking system, and that is just what we must do if we are to invade South America commercially.

The young German just entering business has been taught to speak three languages; the young American often cannot speak his own, and his brusqueness grates against the pernicious politeness of the South. This is a problem for our schools.

The Germans have worked out their shipping methods to a nicety, because they have studied them so thoroughly. When goods are to be shipped to a certain destination, they know whether coolies, burros, or auto trucks are to be a part of the haul over the last lap of the journey, and the goods are packed accordingly. Are we willing to devote this painstaking, but profit-inserring, attention to detail?

The attitude of the government must have an extremely important influence on our success in distributing through foreign ports. The Kaiser is a business man. His consular and diplomatic service has been made to subserve and advance German industries, and to subsidized merchant marine is an important factor. Even governmental pressure has sometimes been brought to bear on small manufacturers, who, on account of their smallness, were unable to serve the trade efficiently and at the same time yield a fair return to their stockholders, causing them to consider and thus operate more economically.

I know of no American banks in South America. Inasmuch as custom has fastened a system of extremely long credits on the country, our banks must go with us to carry these credits.

(3) *How is the opportunity to be cultivated?* In a word, by planning; by preparation. Certainly not by going to the South American countries in the spirit of adventurous trad ers, dictating our own business methods, nor yet by using them, as in the past, as a dumping-ground for over-production "Cheats and purposes" should be our slogan. Only in this way can we build South American business on such a solid foundation that, when the floods come and the winds of competition blow, it will not be moved.

F. S. Tsany.

Manager National Lamp Works of the General Electric Co.
New York.

Why We Will Find It Hard to Enter South America

Frankness compels me to say that I doubt if the American manufacturer ever will secure more of a relative foothold in the trade of South America than he now possesses.

Why?

Because he neglected his opportunity through the years gone by and has not now either the patience or the philosophic temperament to diagnose the situation from a business and commercial standpoint and measure up spots.

Let us not deceive ourselves, but look at this situation in South America as it actually is: Germany, England, France, Belgium, and Italy have Europeanized South America when it comes to domestic and foreign trade and commerce. These countries not only supply South America with the products of their factories, but they have supplied that continent with the money that has developed its own resources. The United States has had no part in it.

The Monroe Doctrine may have been potential as against a European flag, but it has not blocked one European dollar from entering a permanent foothold in the southern half of this hemisphere.

[illegible] ...ment to commercially dominate South America as ...ave politically, and the people of both continents need com... [illegible] ...ment, now is the period of trade renewal and con... [illegible] ...ve opportunity among the rest. Now is the time to visit ...ith the idea of becoming acquainted, to be impressed with the fact ...ople have commercial ideals, that European capital developed their mines, built their railroads, constructed their public utilities, financed their national debts, supplied ocean ships, now gives stability to their banks, provides officers to give instruction in their armies and navies, and in every way imaginable has so completely worked itself into the warp and woof of business, social and governmental life as to all but justify the claim to vested right.

In short, the European dollar speaks the language of every country in South America.

How will we get in there permanently now? Certainly not by proceeding on the assumption that while these European countries are at war, we can sneak in, snatch up, run away with and permanently possess that which is related to untold millions in the way of investment, and represents generations of the most patient social and business cultivation. Foreign trade and commerce are not secured and made permanent in this way.

While South America will take what we hurry to her in this emergency, in our government-owned ships, purchased under the spell of commercial hysteria, we must not let the people down there get the impression that we are attempting to take advantage of our wounded and crippled European neighbors in their hours of awful anguish, and thus secretly form a contempt for us.

South America will certainly not forget that until this horrible cataclysm in Europe, there was not a single ship flying the American flag plying between the United States and that country, beyond the Caribbean Sea.

Advising just how to permanently secure a foothold in those markets, I would urge the study and emulation of the methods pursued by European nations through many, many years.

I consider it more timely and important, however, to suggest *how, in my opinion, we cannot permanently secure such a foothold.*

We cannot do it by offending the South American's sense of what is manly, fair, and right. He is proud and chivalrous. He scorns to take advantage of a fallen foe either in war or trade, and I warn American business men to watch well their ways or they will learn that whatever temporary advantage they may appear to gain in this emergency, will be later thrown back upon them with scorn and derision.

Europe and South America are united, not only by commercial, but by social and family ties. Their people visit back and forth. Tens of thousands of them have homes in both continents. They speak each other's language, their families are intermarried. The mere suggestion that American manufacturers can throw business and commercial blandishments round South America that will cause those people to weaken in their loyalty and affection for their European relatives and friends while they are engaged in a life-and-death struggle is absurd.

I have spent considerable time in South America and I know how those people prize intimate acquaintance, how they value warm friendships, and how they cherish social and business traditions associated with the years that go back to long ago, and I know that when this cruel war is over they will fly to the arms of their old friends in a way that will cause "Uncle Sam," with his emergency-bought ships, to gasp in amazement.

So I would say that the way to permanently secure a foothold in the trade and commerce of South America would be to hold ourselves in absolute control through this trying ordeal abroad, curbing our enthusiasm and ambition for foreign trade, nor attempting to ride the knapsacks of our fallen commercial competitors. Let us supply South America with whatever she needs in this crisis, doing it in a dignified, whole-hearted, generous way, sending the cash. That is not sterling. Then when Great Britain, Germany, France, and other European nations who have developed South America with their brains and money are themselves again, we can approach that field in a commercially diplomatic way, and on the theory that the Panama Canal has awakened our interest in business opportunities, trade advantages and undeveloped resources, down there, on the virtue and merits of our goods and the integrity of our methods and intentions solicit a fair share of their patronage and an equal opportunity in their undertakings.

And in the meantime, let us urge the American Congress to give such assistance to those having the courage and ambition to embark in the over-the-seas shipping, as will put vessels on the high seas flying the American flag, to assist in taking care of whatever business may be developed.

E. G. Buckner.

Vice-President E. I. du Pont de Nemours Powder Co.

The Adoption of European Methods and Co-operation of Our Government Requisites in Building Up Export Trade.

The first consideration is that the American producer, seeking a foreign market, must look upon such a proposition as necessarily involving the opening of a definite and permanent branch of his business, and as soon as he can ascertain what character of goods such foreign market requires, he must equip himself permanently to meet the demands of such market. No permanent foreign trade can ever be built upon the idea of merely utilizing such a market as an outlet for surplus products.

No better method can be adopted to secure and develop South American trade than has been successfully employed by such countries as Germany, Great Britain, and France For example, Germany's method has been to send a specially fitted representative into South America to make purchases of products in actual use and demand, ascertain selling costs, and then to manufacture these products in the style, size and character demanded, and at a price which will enable successful competition with selling trade.

The second consideration in the development of a permanent foreign trade for this country rests upon the willingness of the Government to assist.

Every intelligent business man, having any connection with shipping matters, knows that our maritime and navigation laws have lost to us annually, for the past sixty years, not only a very large foreign trade, but also hundreds of millions of dollars in transportation charges. These laws should certainly be either repealed in whole or modified beyond recognition and new laws should be adopted, based on the experience of other nations, whose object shall be the upbuilding and not the throttling of an American merchant marine.

The very quickest changes which our trade is now passing shows that *we should have a home-made merchant marine.* This is necessary not only for the extension of foreign trade, but for the protection of the trade which we now have At the present moment, America has approximately 14 per cent of the export trade of the world. Less than one hundred years ago American ships carried fully 90 per cent of our then foreign shipments. To-day only a small percentage of this trade is carried under the American flag Of the entire export tonnage of the world, 58 per cent is carried under the flag of Great Britain, 14 per cent Germany, 8 per cent United States, and 5 per cent France

The reason for America's lost foreign shipping and the failure to develop on any scale the shipbuilding industry, with all of its ramifications and possibilities for the investment of capital, employment of labor, purchase of supplies etc., is due to the severe hardships placed upon vessels sailing under the American flag, and the failure of the Government to enact such laws as will enable the construction of American ships, the upbuilding of a great shipbuilding industry, and the operation of American ships on an economical basis

It is claimed that it costs from 25 per cent to 40 per cent more to build and equip a ship in America than in any other country, and from 25 per cent to 30 per cent more to operate an American ship than the ship of almost any other nation. A vessel of 10,000 tons under the British flag can, therefore, be maintained as cheaply as a vessel of from 6,500 to 7,000 tons under the American flag If some of these handicaps could be eliminated or overcome by Government aid, the vast increase of trade and commerce to result would certainly bring great prosperity to American labor as well as capital

I, personally, do not believe in government-owned merchant ships. I should much prefer to see this Government make loans on American-built bottoms of certain tonnage, up to a certain per cent of the actual cost of construction, at a rate of interest sufficiently low say 3 per cent, as would attract and inspire capital sufficient to develop a real home made merchant marine It is a fair assumption that after a short period, this industry, once established, would be able to stand without Government aid As a temporary measure solely and to meet the present emergency, the same principle of Government loan might be applied to foreign-built ships taking out American registry

A third consideration in the establishment of permanent foreign trade is the development of necessary banking facilities for handling credits between foreign countries and the United States. At the present time, America buys probably 50 per cent of the coffee, rubber, hides, and wool produced in South America. Practically all of this business is settled by exchange on London or some European city) Here is a credit balance in favor of South America which, as soon as a sufficient trade is developed with South America for the sale of American goods, can be utilized against the debits thus created and settlements made through American banking institutions already opening branches in the principal South American cities.

Banking facilities and trade always follow the flag and there is little doubt but that the American banker will produce all the banking facilities necessary to handle the South American trade, as soon as the American producer seriously enters the field and the American Government, in advance of an intention to foster the development of such a trade.

A good example of the readiness of trade to expand upon the slightest encouragement is found in the apparent results of the reciprocity agreements made between Brazil and the United States in April, 1891. The exports of cotton piece goods, bleached and unbleached, wearing apparel, and other cotton manufacturers, which in 1890 were $684,584, in 1890, $813,700, increased in the three following succeeding years during which such reciprocal agreements were in force, to $1,146,980, 1892; $1,402,569, 1893; $1,588,089, 1894

A further consideration in the development of foreign markets is found in the assistance which bankers can, and usually do, give in financing loans to foreign governments which furnish a trade outlet When the Balkan war broke out, the more important countries in South America were seeking loans from European banks. Naturally, with the development of that war, these loans were discontinued and the three countries were again seeking, and seemed in a fair way to obtain, similar loans of European capital. These loans will now probably be deferred for a long time. This is an opportunity for American bankers, if sufficient funds are at hand European financiers have frequently loaned money to these governments with the stipulation that a large part of it be used in buying the products of their mills American bankers entering this field can obtain similar concessions If such loans could be made, a large part of the funds would come back to the United States in payment for our goods

William C Breed,
Member of Breed, Abbott & Morgan,
New York *Attorneys and Counselors.*

An Efficiency Engineer's View of American Opportunities in the Present World Crisis

Those who have been many years in active life know that it takes about a generation—twenty-one to thirty-three years—to evolve, develop, and succeed in something new. Occasionally the time is shortened, as in the case of that glorified American manufacturing genius, Henry T Ford, but in most cases the rule holds, as in the case of James J. Hill, Rockefeller, Carnegie, Guggenheim, Woolworth, Larkin, and others

Therefore, to attempt to use the present crisis to develop wholly new lines of American business actively will cause disappointment. The time is not sufficient in which to make mistakes and retrieve them. For instance, the war may stop the manufacture and importation of Brussels lace It would be highly foolish to attempt to transplant the industry to the United States. It is manifestly an industry that might take a hundred years to develop. We import about $8,000,000 of toys annually. We shall not get them this year. I would not recommend to any American to start the industry of making Noah's arks or tin soldiers.

On the other hand, there is an excellent opportunity to push those competitive lines in which we already have a start

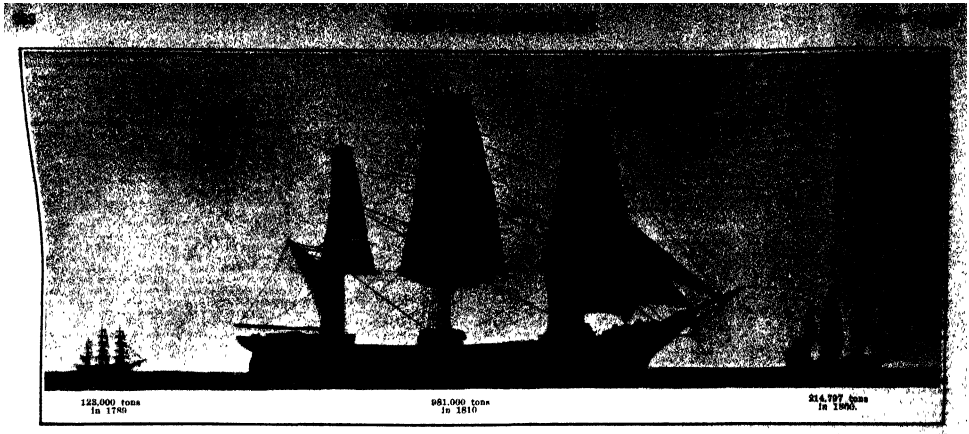
Our export of coal, of lumber, of agricultural products, ought to be pushed. Our farmers are getting very little for their peaches this year. They were not prepared to can or to dry them. What a pity! Agricultural implements ought to be pushed and German trade be supplanted. Other existing manufactures ought to be pushed.

What we most need as to foreign trade is to supplement and develop existing agencies rather than to embark on a long-winded attempt to create new agencies Why should we wait for an American merchant marine when there are hundreds of British, French, Scandinavian, Japanese, and Greek steamers available, all of which can operate under charter more cheaply than any vessel under American flag?

Let us play the games we have learned, not switch onto new ones.

Harrington Emerson.

New York.



The rise and decline of our oversea shipping between 1789 and 1860.

Our Merchant Marine; Past, Present and Future

I. The Past

By Winthrop L. Marvin, Author of "The American Merchant Marine. Its History and Romance"

FOR years before 1898 the American people had desired and sought an Isthmian Canal, but the Spanish war and the voyage of the "Oregon" made that canal a certainty. So the great European war of 1914 will make a certainty of an American merchant marine in overseas trade.

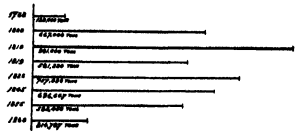
We had such a merchant shipping once. The story of how we secured it and of how we lost it may help to an understanding of how it may most surely be regained. The War of the Revolution showed the maritime genius of the American race. John Paul Jones's victorious Yankee tars were merchant sailors and fishermen, and the crews of our privateers afloat in 1777 almost equaled the strength of the Continental Army under Washington. Never had British commerce been so mercilessly harried, right in the chops of the Channel and the Irish Sea. Parliament in alarm ordered a special investigation of the Yankee private-armed cruisers, which captured or destroyed three times as many of the enemy's vessels as did the entire Continental navy.

But these incomparable ships and men could make no headway in competition with wealthier British merchantmen after the war had ended. The period from 1783 to 1789 was one of desperate poverty for the sea carriers of the new republic. In 1789, the first year under the Federal Constitution, only 123,000 tons of shipping were registered under our flag for ocean trade, and all but 23 per cent of our own imports and exports were conveyed by foreigners.

American Shipping in Washington's Time.

That was the condition of American shipping when George Washington became the first President of the United States. A single decade later, in 1800, fully 667,000 tons of shipping bore the Stars and Stripes to foreign ports, carrying 89 per cent of American commerce. Another decade passed, and in 1810 American vessels for overseas business registered 981,000 tons, conveying 91.5 per cent of our external trade. The mercantile history of the world affords no parallel to the swift expansion of the American merchant marine in the first twenty years of our national existence.

What had happened in 1789 was this: Congress, on the initiative of Washington, Madison, and Jefferson, had made the merchant marine a nationally protected industry—the most vigorously protected industry in America. This is no time and there is no space for an academic discussion of protection versus free trade; I am merely reciting a historical circumstance. In 1789 and for many years thereafter an American ship was permitted to land her imported cargo on the payment of a rate of duty 10 per cent less than that exacted



The rise and decline of American shipping.

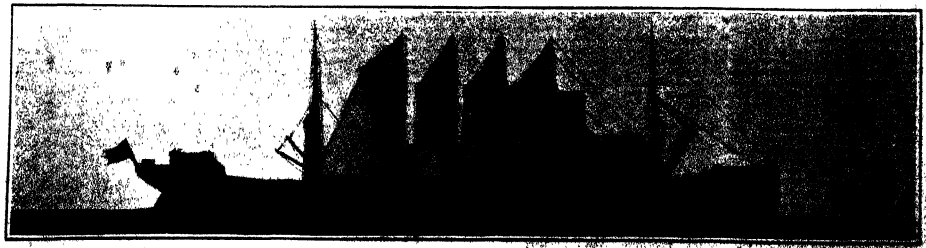
on a similar cargo brought in a foreign ship, and in those years there was almost no free list—almost every foreign article was dutiable. An American ship paid a tonnage tax of 6 cents a ton on every arrival; a foreign ship paid 50 cents. And as a special inducement to develop a direct East India trade, tea imported in an American ship straight from the Orient paid a duty of from 6 to 20 cents a pound according to variety, while tea imported in a foreign ship paid from 15 to 45 cents. This was prohibitive protection; it was intended to be such. No teas came to America except under the American flag, and Boston, Salem, and New York whitened the Indian Ocean with their adventurous sails.

A reaction came after the War of 1812. Astute British diplomacy outwitted our amateurs, and won a cessation of the protective customs and tonnage rates in the direct trade with the United Kingdom. But elsewhere Washington's policy was maintained unchanged, and American shipping, which had fallen to 581,330 tons in 1819, rose again in 1828 to 757,986 tons, carrying 88.9 per cent of our total commerce, or almost as much as in 1810. In 1827 the London *Times*, lamenting America's maritime growth, exclaimed, "Her starred flag is now conspicuous on every sea and will soon defy our thunder."

A Fatal Blow at Commerce.

In a mood of fateful overconfidence, Congress now passed the so-called reciprocity act of 1828 opening the carrying trade from other countries to the ships of Great Britain and our other European competitors. This was done by the South and the agricultural States against the protests of the merchants and the shipowners, and as Prof. Soley in his "Maritime Industries" well says, it wrought "a great and lasting injury." The proportion of American commerce conveyed in American ships "began almost immediately thereafter to fall, and it has been falling ever since, until it has reached almost the point of extinction." American shipping in 1845, though it had rallied somewhat from the low point of the first years of reciprocity, had not reached the maximum of 1810, and the share of the American flag in our own carrying had fallen to 81.7.

Now came the first steam lines of the North Atlantic and the Yankee clipper ships. Great Britain was first in the field with subsidies. She had cajoled us into abandoning most of the protection of preferential customs rates and tonnage taxes, though this was not wholly given up until 1849, and had herself adroitly launched upon the more direct and vigorous protectionism of liberal mail pay from the royal treasury. America was outmaneuvered and soon after vanquished, and this is a most important historical fact to remember at the present time. Under the preferential policy,



Comparison showing the growth of our coastwise shipping between 1880 and 1916. The sailing ship [illegible] we had in 1860, and the large steamer our coastwise shipping in 1916, amounting to [illegible] tons.

[illegible] took up the potent [illegible] of subsidy, on which she has expended, to her immense advantage, $400,000,000 in seventy years.

Steamship Lines Subsidized.

For a time, on the initiative of a Southern Democratic President, Polk, the United States followed the British example, and subsidized new steamship services to Europe, the West Indies and South America. The triumphs of the American sail clippers were quickly repeated in the performances of American steamships, which held the record on every ocean. Our deep sea steam fleet increased swiftly from 20,870 tons in 1849 to 115,045 tons in 1855, almost equaling that of Great Britain, which had subsidized her lines much earlier. "The prospect, therefore, at one time," said David A. Wells, "was that the United States, although late in the start in this new department of foreign shipping, would soon equal, if not overtake, her great commercial competitor."

But, unfortunately, the sectional quarrel of North and South over slavery was now fierce in Congress. The Southern men, led by Jefferson Davis, saw a chance to strike a blow at Northern sea power and commercial power by canceling the mail subsidies which put American steamship lines on even terms with their British rivals. This was done—to the injury of the North, indeed, but to the heavy loss, as it soon proved, of the entire country. Though the American steamships as a rule were the better ships, exactly as the American clippers were, they were beaten off the routes—before the Civil War began. One of the great American merchants of that day was A. A. Low, father of Hon. Seth Low of New York. No man of his time better knew the shipping trade, and he has left his eloquent witness that "the English have deliberately and intentionally driven the Americans from the ocean by paying subsidies which they knew Congress would not pay. . . . They have driven us from the ocean by that policy as effectually as they ever drove an enemy from the ocean by their guns!"

All official facts sustain this impressive judgment. American shipbuilding, which reached its climax in 1855, under the impulse of the mail subsidies, the California gold discoveries and the Crimean War, decreased sharply from 583,450 tons in that year to 214,797 in 1860—"the swiftest and most alarming shrinkage in our national history." This was all under low tariffs for revenue only, before the first Morrill protective tariff, before the firing of the first Confederate guns on Sumter.

Civil War a Subordinate Factor.

The Civil War itself was only a late and subordinate factor in the decline of the American merchant marine. And that decline was not due to the economic change from sail to steam, from wood to iron. For American yards, under the mail subsidies, quickly built more and better steamships than English yards, with better boilers and engines—the despair of British observers at that time. And Boston, New York and Philadelphia were launching iron hulls before 1861—the handiwork of the same mechanics who soon after created in the monitors the most formidable armored navy in the world.

Much humbug has been written about the decline of the American merchant marine by men in this country and abroad who were anxious to serve the interests of the European steamship companies which now do nine tenths of the ocean carrying of the United States. It has been suggested, for example, that our nation could have saved itself in 1855-1860 by the purchase of "free ships" from British yards. But does any sane person believe that the mere purchase of a British steamship would make it possible to run that steamship profitably in competition with the Cunard Line, which was then receiving a subsidy of nearly $900,000 a year from the British government? To ask such a question is to answer it.

Since the Civil War every effort to extend national aid in any comprehensive way to our merchant fleet in overseas trade has been defeated by the stubborn sectional opposition of the West and South, which struck down the mail subsidies before the war and are directly and wholly responsible for the fact that there is almost no American shipping now to carry their grain and cotton to Europe.

The Stars and Stripes would have vanished from the seas, and American shipbuilding would have vanished with them, if it had not been for the steady maintenance of the century-old laws reserving the American coastwise trade, on river, lake and ocean, to the ships and sailors of the United States. It is this coastwise [illegible] made possible the launching of the [illegible] and the "Olympia," before the war with [illegible] of the present American [illegible] American coastwise shipping has grown and prospered, from the [illegible] tons of [illegible] to the 6,816,000 tons of 1912—a fleet nearly twice the foreign-going and coastwise merchant tonnage of the German Empire, and considerably greater than the whole shipping of France, Norway and Italy combined.

Europe's Fighting Motor Cars

By Theodore M. R. von Kéler

THERE is no doubt whatsoever that Germany's wonderful rush across Belgium and Northeastern France to within a short distance from the walls of Paris, was due to two things: a first-class mobilization plan and an equipment in motor vehicles second to none in the world. When the history of the present war comes to be written in later years, it will be found that the motor car, the motor truck, the tractor, motor-drawn cannon, and motor-driven aerial fleet have far exceeded the wildest hopes of their advocates.

Even from the meager reports available at this time, less than two months after the beginning of hostilities, the student of military tactics can judge the tremendously important rôle played by the motor vehicle in the rapid advance of the Germans, the collection and transportation of the British expeditionary forces and the swift concentration of the recruits and reservists at the army corps centers. What the auxiliary fleet of commandeered pleasure cars has accomplished along other lines is too complex a picture to be painted in a few words.

In a consideration of the assistance rendered by motor vehicles to the respective European governments in this titantic struggle, one must naturally take as a basis the number of these cars available Exact figures are of course out of the question, for many factories on the Continent, particularly in Germany, have for months past been practically under the orders of the government and have manufactured and assembled trucks for military use, of which no hint appears in the official statistics, or in the subvention contracts of France, Germany, Austria, and Italy. But by means of a careful estimate of the number available in the early spring of this year, and the capacity of the larger companies specializing in this sort of work, it is possible to obtain a fairly accurate total.

Germany's Automobile Strength.

In Germany, military motor trucks, complete with trailers, to the number of 1,150 were under subsidy on April 1st this year In addition the Empire had 14,700 commercial cars, capable of being converted into military vehicles. The order of mobilization placed at the disposal of the German General Staff approximately 15,000 delivery cars, not counting the trailers. In addition, the German army comprised at the beginning of this year the following "special" vehicles: 50 completely equipped motor kitchens, 100 motor ambulances, 500 motor-driven cannon, and 4 powerful tractors, which have been especially useful in drawing the new 42 centimeter siege guns of the artillery. About 200 armored cars, fitted with Maxim guns; 15 searchlight cars and a number of aeroplane repair wagons make up the remainder.

The government has commandeered the majority of all the pleasure cars in the Empire, amounting to probably 60,000 vehicles, for use by officers at the front, and for rapid communication in the rear of the army. Whole regiments are reported to have been shifted under cover of night by means of big fleets of motor cars to points 60 and 100 miles distant. In addition, there are with the army more than ten thousand cyclists and motorcyclists.

The shortage of gasoline, which has been the subject of much comment in the American daily press during the past week, is of little importance, as all the military vehicles can be run with equal facility on benzol and denatured alcohol, both of which fuels are available in considerable quantity in Germany.

France and the Motor Car.

Although more time and money have been spent by the French government in developing a satisfactory fleet of motor trucks, the total number of those is smaller than in Germany. At the last French army trials 110 separate units took part. The total number of subsidized army trucks is placed at 1,200, and the number of available motor trucks of all sizes at about 10,000. There are also large numbers of motor-drawn cannon, aeroplane guns, ambulances, and special cars, of a type similar to those used in the German army. France boasts of 95,000 pleasure cars, and some 20,000 buses, cyclecars, taxicabs, etc.

Great Britain's Automobile Strength.

With 18,000 motor lorries (as they are called) 228,000 pleasure cars of the large and medium type, 30,000 cyclecars and 185,000 motorcycles the United Kingdom should really be at the head of the list. However, Great Britain's big fleet of motor vehicles is a conglomerate of everything, without a standard. The British army trials succeeded in rounding up three manufacturers of trucks, who entered one vehicle each. Little attention and interest is manifest in Great Britain in army maneuvers in times of peace. Reports from France have it that about 2,000 motor trucks have been sent from England to accompany the expeditionary force, and these trucks are proving a source of much trouble to the army heads. Poorly supplied with spare parts, there is a great deal of waste and loss of time every time a part breaks under the severe strains of active war The metric system in use in both France and Germany and the strict demand for interchangeability of the various parts on trucks of similar carrying capacity, makes it possible for the Germans or French to "borrow" necessary replacement parts from disabled or captured vehicles of the enemy. The British truck is dependent on its home supply, and cannot even utilize the French repair equipments The number of special vehicles adapted for military use in the British army is comparatively small, not a single armored car being in its possession at the beginning of the war

Eye witnesses of the German advance into France from Belgium say the first sign of the army consisted of six to twelve aeroplanes flying at different heights covering a width of ten and more miles Slightly behind these aeroplanes came a fleet of twenty and more armored motor cars, capable of making easily 40 miles an hour Against such a reconnoitering force the British cavalry was at a great disadvantage as the quick-firing guns on the cars easily disposed of small bodies of troops, and the aeroplanes aloft gave notice in time of the advance of re-enforcements Except in the thick of a battle no report has come from the battlefields showing that the advance army ever ran into an ambush With armored cars scouring the ground below and aeroplanes peeking into things in general from above it would have been impossible for large bodies of troops to hide. In the beginning of this month strong pressure was brought by Gen. French, it is reported by British motor men, and some hundred touring cars were fitted with steel shields in such a manner as to make a presentable armored car squadron Simultaneously the rapid advance of the Germans in the North stopped, chiefly, it is stated, because of the increased mobility of the English forces and the better protection given to the outposts by the armored cars, which engaged the German cars in pitched battles instead of fleeing before them, as the horsemen had been compelled to do before

Where Russia Stands.

There are but 500 serviceable motor trucks in the Czar's domain, and nearly all of these are German and French. Several large orders have been received by American truck manufacturers, and nearly 1,000 of these vehicles are to join the Russian armies this year If shipments can be made, they are likely to prove an important factor in the struggle

The Other European Powers.

Austria has about 1,000 motor trucks and some 14,000 pleasure cars, *Hungary* less than 400 trucks and 7,000 pleasure cars; *Italy* can furnish a total of 12,500 pleasure cars and about 500 trucks of both small and large sizes; *Bulgaria* has less than 3,000 cars, *Servia* probably the smallest number of all the powers involved, namely 125 motor cars; *Turkey* has about 700 pleasure cars and about fifty military motor vehicles of special types made in Germany, *Roumania* counts 1,700 pleasure cars. *Greece*, early this summer placed an order for 400 motor trucks with an American firm, and is said to have received them just before war started; in this case it boasts of the total of 550 effective motor vehicles, not counting touring cars

These are the motor fleets of the nations at war or likely to be at war. It is too early as yet to form a final opinion as to their value in a long drawn out war and their resistance to the elements under adverse conditions But they have proven themselves an invaluable aid to an attacking force, bent on pressing forward with great speed into a hostile country The next few months will show their full value to the modern army.

The German Fleet in the Baltic

ALTHOUGH the fleet of dreadnoughts and battle-cruisers of Germany, numbering sixteen ships in all, and its second line of twenty-three dreadnoughts has not ventured out to engage the British fleet in the North Sea, there is little doubt that it has been actively employed in attacking the Russian Baltic fleet and the various Russian seacoast cities and naval bases, also there have been engagements between sections of the Russian and German fleets. The accounts which have come to hand of these operations are limited and give only an incomplete idea of what has taken place. Our double page engraving in this issue represents a fleet of German dreadnoughts steaming in battle formation of line ahead, with one of the large naval Zeppelins maneuvering above it.

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Cream Separators — Corn Shredders — Lighting Plants

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Notes for Inventors

A Device that Automatically Plays and Removes Talking - Machine Records.—Graham J. Brogan, of Mt. Vernon, N. Y., has secured patent, No. 1,099,913, for a talking machine in which the sound records or disks are supported one upon another in a series, and are automatically applied one after the other to the pin of the machine.

Bottle Cap Remover.—In a patent, No. 1,100,818, to a Grand Rapids, Mich., man, is shown a bottle cap generally of the crown seal variety whose body portion is constructed in such manner as to facilitate the removal of the cap without a separate tool.

Improving the Dictation Graphophone.—Thomas H. Macdonald, of Bridgeport, Conn., assignor to American Graphophone Company of same place, has patented, No. 1,100,024, a dictation graphophone which provides, in a single construction, a "speaker" that is adjustable in any one of three positions (1) where it becomes a light reporter, (2) where it becomes a heavy reproducer, and (3) where it is neutral.

A Number of Edison Patents.—Thomas A. Edison has secured patents No. 1,099,241, for a rectifier, No. 1,099,346 for an improved mounting of the stylus of a phonograph reproducer, and No. 1,099,347 for a similar invention; No. 1,099,348 involving improvements in the stylus lever and floating weight associated therewith, and No. 1,099,349 for a method of making sound record molds.

Bombay Road Mirrors.—It is reported that the municipality of Bombay contemplates using road mirrors at dangerous points in streets or roads. This idea in itself is not new, having, it is said, been utilized with success in a number of English towns, and it is probable any considerable demand would cause some activity in this line of invention.

Players Combined with Moving Pictures.—A patent, No. 1,102,595, has issued to Herbert Knight, of New York city, in which what the inventor terms a composite dramatic production is carried out partly by living characters and real objects and accessories, and partly by moving pictures.

An Adjustable Bifocal Eye-Glass.—Benjamin N. Hanna, of Pittsburgh, Pa., has patented, No. 1,102,909, a bifocal eye-glass whose nose-piece is so constructed that the glasses when in position on the nose of the wearer may be thrown to alternate positions so that in the line or level of vision the wearer may use alternately the distance lens or the reading lens of the bifocal.

A Milk-Skimming Device.—A method which is said to be very good for removing all the cream from milk contained in a bottle or like vessel is to use a large round disk of rubber which takes a slightly concave shape, it being hung upon three light aluminium rods or wires. Slipping the disk in edgewise and below the surface, it then takes the flat position and can be drawn out with all the cream.

Making Tea While Traveling.—Tea or other infusions can be very readily made, for instance when traveling, by the use of a newly-invented device of a very simple kind. It consists of a cap made of wire gauze which has the exact shape of the tea-spoon and fits upon it by a suitable clamp. Putting in the tea, etc., the cover is placed on, and the spoon is put in a cup or vessel of boiling water in order to make the infusion. This avoids carrying a teapot, and will often be found serviceable.

An Automatic Smudge Pot.—Frederick J. Fisher of Oakland, Cal., has patented No. 1,095,496, a smudge pot, in which a self-operated device ignites the fuel in the pot when the temperature falls to a certain predetermined degree.

A Picture Design Patent.—Design patent No. 45,429 has issued to Denison Manufacturing Company of Boston as assignee of Clara M. Nead of Rahway, N. J., for a paper sheet or similar article including a design in the form of a picture landscape which is specifically described in the patent.

Improvements in Comb Manufacture.—Patents Nos. 1,092,861 to 1,092,864, inclusive, have been issued to the Arlington Company of New York city, as assignee of Frederick Wieland, for improvements in the manufacture of combs, particularly of the zarylon sheet from which the comb is formed, the [illegible] of forming the teeth and the [illegible] of the finished comb.

An Improved Key.—Oscar B. Wilson, of Saginaw, N. Y., has secured patent No. 1,094,478 for a key with an insulated handle portion especially designed to prevent injury from short circuiting when the key is used in connection with safe boxes, fire alarm boxes and other electrical equipment.

Automatically Recording the Ship's Course.—Patent No. 1,094,827 has been secured by Francesco Spalazzi of Rome, Italy, for apparatus which during the movement of a ship automatically records the course of same upon a drawing sheet or even directly upon a sea chart when a suitable drawing scale has been provided.

A Divided Bed.—In patent No. 1,094,670 Frederick W. Roberti of Los Angeles, Cal., provides a partition for dividing a bed into two sections separate from each other and secures the bed clothing in such manner as to form two separate compartments in the same bed, producing, he claims, practically the same advantage as twin beds.

Centrifugal Pump Structure.—Patent No. 1,094,836 has issued to Henry R. Worthington, a corporation in New Jersey, as assignee of Carl George de Laval of East Orange, N. J., for a centrifugal, turbine and similar pump in which the special object is to avoid the whirling action of the water or other liquid entering the impellers and direct this suction flow so that the impellers will take up the water without substantial change of direction.

Activity in Novel Forms of Poison Bottles.—Some threatened legislation relating to special shaped bottles for containing poison has led to considerable activity in the production of novel designs for poison-containing bottles with a special view to securing a shape which will indicate at once, when grasped, the dangerous contents of the container.

Arc Welding Apparatus.—In patent No. 1,095,300 Theodore Varney of Pittsburgh, Pa., assignor to Westinghouse Electric Manufacturing Company, provides a simple control system by which automatically to govern the current in the welding circuit of arc welding outfits, so that the welding circuit may be maintained substantially constant and the operation improved.

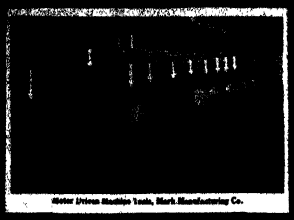
Photographical Records of Liquid Dispensed from a Bottle.—Patent No. 1,095,313 to Charles H. Davids of Brooklyn, N. Y., seeks to prevent the refilling of bottles by photographically recording, as it is withdrawn, the removal of the original contents of the bottle by means of a photographic label applied to the bottle.

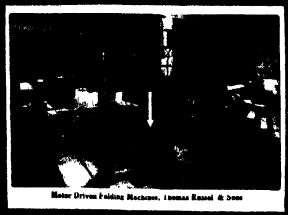
A Punch Machine with a Safety Device.—Patent No. 1,095,497 has issued to Otis Elevator Company as assignee of Ernest L. Gale, Sr., of Yonkers, N. Y., in which a safety device is provided so that the operation of the punch press is prevented when the pick-off device for removing the punchings and scrap is in an interfering position.

How to Nest Pyramidal Cartons.—James N. Pitkin of Los Angeles, Cal., has secured patent No. 1,095,871 for a package in which six pyramidal cartons are joined in series by separable connections so they can be easily assembled to form a complete cubical package.

Protecting a Battleship from Bombs.—In a patent, No. 1,101,590, Joseph A. Steinmetz, of Philadelphia, provides a shield extending over the ship throughout and suitably supported by stanks and booms, the shield being adapted to be filled when desired.

Seeking a Substitute for Cork.—William Sanger, of Orange, N. J., has patented, No. 1,101,965, a method of treating wood to produce a substitute for cork, in which he seeks to remove all acid from the wood and then impregnate it with [illegible] and [illegible] to give [illegible] and [illegible] to the wood [illegible] cork for use.





Factories that Look Ahead

FOR many manufacturers this is the beginning of a period of business aggression. New campaigns are being planned. Machinery is being brought up to date. Methods are being modernized.

In the past, too many concerns have had sales efficiency counteracted by factory deficiency. The sales department requires: First, increased production; 2nd, improved quality; 3rd, reduced costs.

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and the service that goes with it, have increased production, improved quality and reduced costs for scores of factories in many different industries.

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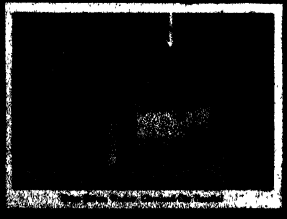
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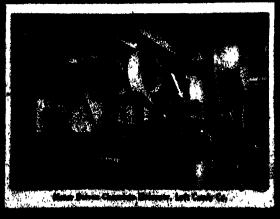
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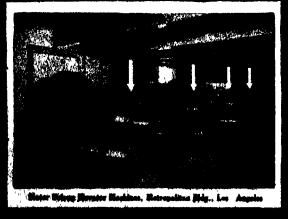
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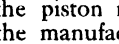
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Mobile Siege Guns in the Present War

(Concluded from page 267.)

the highest class of military roads, roads which as far as possible shall be free from heavy grades. Therein, no doubt, is to be found one predisposing cause which led the Germans to cling so tenaciously to their plan of campaign through Belgian territory. The magnificent highways through Belgium and northern France, stretching, as they do, through comparatively level country, are ideal for the transportation of batteries of these heavy siege guns rapidly to the fortifications of the French capital. At the outset of the war, the world wondered how the Germans could expect, as they evidently did, to be within the city of Paris in a few weeks time. The answer is to be found in their belief in the invincibility of the huge armies which they were prepared to pour through Belgium, and in the ability of this 11-inch mortar to cut a wide swath through the engirdling fortifications of Paris. The Germans, in our belief, never contemplated for a moment, a complete investment of Paris such as they made in 1870 to 1871. These 11-inch mortars have made such an investment unnecessary. Had the French-British resistance to the enveloping tactics of the German right been less successful, it is probable that the German army would have been in Paris at the present time.

We direct attention to our illustrations of a Krupp 11-inch mortar, installed on a permanent concrete base and protected with a shield of 2½-inch armor. Except for the overhead shield, the emplacement is similar to that employed by the Japanese in the reduction of Port Arthur. It necessitates the construction of a massive circular concrete base in which are embedded holding-down bolts. Upon this is placed and firmly bolted down the lower ring, or race, of a turntable upon which, by means of a rack and pinion, the gun is traversed.

As representing light siege artillery, we present two illustrations of an 8.26-inch mortar upon a mobile mounting. This gun is fired, like the howitzer, from its traveling carriage, and it does not require the preparation of any special platform. The whole equipment weighs about five tons when it is in action. It is provided with a constant recoil. Another illustration shows a 4.7-inch quick-firing field howitzer, with a controlled recoil, manufactured by the celebrated Ehrhardt firm.

A development in European field artillery which is of great substance in promoting rapidity of fire is shown in our illustration of a 7.5-centimeter quick-firing field gun manufactured by Krupp for the Danish army. When this piece is limbered up for transportation, the gun caisson is so arranged that the quick-firing ammunition is carried with the nose of the projectile down and the cartridges in a vertical position. When the gun is unlimbered and run into battery, the caisson is wheeled around and tipped up so that the ammunition is in the horizontal position. The heavy steel doors are then opened on each side, and above and below, as shown in the illustration, and by this arrangement not only is considerable protection afforded to the gun detachment, but a minimum of time is consumed in passing the ammunition from the caisson to the breech of the gun.

The Turret Fort

(Concluded from page 268.)

of a 12-inch turret with one half open, so that the arrangement and cross-section of the turret and its plates could be seen from the outside. It was then intended to put up such turrets in the coast defences of America. But other ideas have prevailed later on.

The citadels of the Antwerp forts have 6-inch turrets, while smaller calibers for the defense of the moats, etc., are placed and protected in other iron and steel constructions.

Our illustration shows a turret and all its essential parts, the front wall taken away [illegible]

[illegible] the chief type [illegible] the location [illegible] shows the two [illegible] and their [illegible] existing [illegible] fire on the [illegible] cross section of the [illegible] iron ring, the stone and cement [illegible] resting from this ring on the [illegible] plateau and concealing the [illegible] masonry and galleries, as they [illegible] cupola and guns remain visible.

The two smaller illustrations are reproductions of the first photos the [illegible] AMERICAN has received, showing the frightful effect of the fire of the big southern German howitzers on the fortifications of Liège. The iron and steel forts were completely demolished after a few rounds.

Attack and Defense by Submarine Mines

(Concluded from page 271.)

extensive use in the present European war. The views have been redrawn from sketches which appeared in our esteemed contemporary *The Sphere*. The mine itself, containing the explosive charge, is a hollow steel sphere filled with explosive and provided with a detonating charge and a trigger which serves on being struck by a ship to explode the mine. From the bottom of the spherical mine a length of cable passes to an anchor chamber, where it is wound upon a windlass; and, extending below the anchor chamber, is a plummet weight which assists in bringing the spherical mine to rest at the required depth. Before the mine is dropped from the mine ship, the plummet line is unwound until the plummet hangs at a depth below the anchor chamber equal to the depth at which the spherical line is to float below the surface of the sea. The anchor chamber and its plummet begin to sink at once; but the spherical case, being buoyant, remains at the surface. During the sinking, the cable between the spherical mine and the anchor box is unwound until a depth is reached at which the plummet rests on the bottom, when, the strain on the plummet line being taken off, a pawl to which it is attached engages the windlass and prevents any further unwinding of the cable from the anchor box to the spherical mine. The anchor box being heavier than the buoyancy of the spherical mine, continues to sink until it rests on the bottom, with the mine above it floating at the predetermined depth of from ten to fifteen feet below the surface of the water.

When a ship strikes the spherical mine, the latter is rotated and the contact lever is brought into touch with the hull of the ship, and by its action detonates the mine. In order to reduce the chances of a ship's passing unscathed through a mine field, the mines are sometimes laid in pairs, each pair being connected by a length of cable supported by floats, as shown in our illustration. In this case, when the bow of a ship engages the connecting cable, the two mines are drawn inwardly against the side of the ship, the effect, or course, being doubly destructive.

The only possible defenses against mines are countermining and sweeping. In the former case an attempt is made to set off the mines by detonating high explosives among them. The more effective method is to remove the mines altogether by "sweeping" operations, which are carried out as follows: Two vessels of light draft, such, for instance, as torpedo-boat destroyers or tugs, or (as in the case of sweeping operations carried out by the English in the North Sea) steam trawlers, proceed through the mine field abreast of each other, say, from 100 to 200 yards apart, and drag over the bottom of the mine field a length of heavy chain, which is connected at its ends to the two mine-sweeping vessels. The chain as it is dragged over the bottom engages each mine as it lies in its path, which can be stroyed by contact with each other or by a few well-directed shots from the vessels of the mine-sweeping [illegible]

Operations of this [illegible]

Running 100 miles on Low Gear, these 116 Franklin Sixes make nation-wide demonstration of air cooling

Each of these Franklin dealers on September 24th ran his Franklin Six-Thirty car 100 miles *all the way on low gear without once stopping the engine*

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Certified Records

Name of City.	Dealer's Name.	Gallons of Oil Used.	Temperature.	Weather and Road Condition.
Akron, Ohio	C. R. Manly	1	68°	Fair
Albany, N. Y.	H. C. Rutter	1	68°	Mud
Albany, N. Y.	G. G. Scott	1	68°	Clear
Albany, Ill.	Andrew Jackson-brewer			Clear
Altoona, Pa.	W. M. Hull			Dry
Asbury Park, N. J.	Geo. R. Leonard	1	68°	Muddy
Bay City, Mich.	W. P. Kneip	1	68°	Rain
Bar Harbor, Me.	Fred L. Savage	1	68°	Rough
Billings, Mont.	Arthur Barth	1	68°	Fair
Binghamton, N. Y.	C. H. Lewis	1	68°	Muddy
Bozeman, Mont.	O. A. Lyman	1	68°	Clear
Brewster, Conn.	Arthur L. Clark	1	68°	Clear
Buffalo, N. Y.	Geo. Chandler	1	68°	Clear
Calgary, Alberta	A. E. Williams	1	68°	Clear
Canton, Ohio	W. W. Baldwin	1	68°	Clear
Carbondale, Pa.	F. S. Carpenter	1	68°	Rough
Carthage, Mo.	C. D. Caulkins	1	68°	Clear
Cayuga, N. Y.	C. E. Hoyt	1	68°	Fair
Clinton, Ia.	W. B. Johnson	1	68°	Fair
Danville, Ill.	C. R. Stanley	1	68°	Fair
Delaware, Ohio	Newman Samuel	1	68°	Fair
Denver, Colo.	W. E. Ensworth	1	68°	Clear
Des Moines, Ia.	Col. C. A. Clark	1	68°	Hilly
Detroit, Mich.	Geo. Gibbon	1	68°	Showers
Columbus, O.	Wm. Gibbon	1	68°	Rain
Cleveland, Ohio	W. Bebb	1	68°	Clear
Concord, N. H.	W. H. Darrah	1	68°	Clear
Cortland, N. Y.	H. L. Terrell	1	68°	Rain
Cumberland, Md.	A. E. Tilman	1	68°	Rain
Dallas, Texas	H. G. Lansley	1	68°	Clear
Dayton, Ohio	F. E. Stephan	1	68°	Fair
Denver, Col.	F. C. Cullen	1	68°	Clear
Detroit, Mich.	W. E. Doughty	1	68°	Fair
Duluth, Minn.	J. D. Pacella, Jr.	1	68°	Hilly
East Clinton, Wis.	H. E. Wood	1	68°	Windy
Elizabeth, N. J.	C. E. Hess, Jr.	1	68°	Hot
Erie, Pa.	John Griffith	1	68°	Muddy
Fall River, Mass.	Brayton Borden	1	68°	Rain
Farmyth, Mass.	Jack Lindberg	1	68°	Rain
Fort Dodge, Ia.	W. H. Shaw	1	68°	Clear
Fort Plain, N. Y.	A. A. Walrath	1	68°	Fair
Galesburg, Ill. Car 1	A. G. Byram	1	68°	Clear
Galesburg, Ill. Car 2	A. G. Byram	1	68°	Clear
Geneva, N. Y.	C. H. Dyer	1	68°	Rain
Georgetown, Ky.	W. W. McCarroll	1	68°	Fair
Grand Forks, N. D.	J. W. Lyons	1	68°	Clear
Great Falls, Mont.	E. D. Bolton	1	68°	Clear
Greensburg, Pa.	E. E. Turner	1	68°	Bad
Greenville, S. C.	R. N. Tannahill	1	68°	Showers
Hampton, Va.	V. Bickford	1	68°	Fair
Hartford, Conn.	H. P. Seymour	1	68°	Clear
Hornie, N. Y.	John Mosier	1	68°	Clear
Houston, Tex.	R. B. White	1	68°	Muddy
Ishpeming, Mich.	S. R. Nelson	1	68°	Heavy
Kalamazoo, Mich.	C. Starr	1	68°	Fair
Kansas City, Mo.	E. F. Williams	1	68°	Fair
Kingston, N. Y.	W. Davis	1	68°	Cloudy
La Crosse, Wis.	Alfred James	1	68°	Fair
Laramie, Wyo.	J. Lovejoy	1	68°	Clear
Lexington, Ky.	T. C. Dodge	1	68°	Hilly
Lincoln, Neb.	Frederick Ryan	1	68°	Fair
Los Angeles, Cal.	R. C. Hamlin	1	68°	Clear

Certified Records

Name of City.	Dealer's Name	Gallons of Oil Used.	Temperature.	Weather and Road Condition.
London, Ont.	F. G. Mitchell	1	68°	Muddy
Louisville, Ky.	G. M. Younger	1	67°	Clear
Milwaukee, Wis.	Wm. F. Sanger	.9	64°	Dry
Minneapolis, Minn.	C. A. McKay	.8	66°	Sand, hilly
Moline, Ill.	D. H. Duncan	2	67°	Clear
Montreal, P. Q.	H. Gentile	1	69°	Muddy
Nashville, Tenn.	John W. Chester	1.2	67°	Fair
Newark, N. J.	W. L. Mallon	.9	61°	Clear
New Bedford, Mass.	S. C. Lowe	1.2	72°	Dry
Newburg, N. Y.	Geo. Mason	.9	74°	Clear
New Haven, Conn.	Cowles Tolman	1.2	90°	Sand, hilly
New York City	G. A. Tisdale	.8	81°	Dry
Norwich, N. Y.	A. B. Jones	3	68°	Bad
Oil City, Pa.	H. S. Phinny	.9	66°	Mud
Oklahoma City, Okla.	J. W. Lee	.4	74°	Clear
Pawnee, Neb.	O. H. Schenck	1	72°	Clear
Pendleton, Ore.	J. H. McCormach	.6	66°	Clear
Peoria, Ill.	S. K. Hatfield	1.2	75°	Clear
Philadelphia, Pa.	Jas. Sweeten, Jr.	1	82°	Roads bad
Phoenix, Ariz.	Geo. Hageman	1	76°	Clear
Pittsfield, Mass.	H. G. Weed	1.3	69°	Cloudy
Pittsburgh, Pa.	W. Murray Carr			Rains
Portland, Me.	W. M. Chellis	1	80°	Hilly
Portland, Ore.	J. C. Daly	1.2	74°	Fair
Providence, R. I.	W. L. Wilcox	1.3	66°	Clear
Putnam, Conn.	O. C. Bosworth	1	80°	Fair
Redlands, Cal.	B. H. Hatfield		82°	Fair
Rochester, N. Y.	G. R. MacCollum	1.3	66°	Rain
Rockford, Ill.	L. J. Thiess	1.1	66°	Hills
St. Louis, Mo.	J. B. Dryer	1.1	72°	Hills
St. Paul, Minn.	A. H. Mark	1.2	62°	Fair
San Angelo, Tex.	M. C. Ragsdale	.8	62°	Fair
San Antonio, Tex.	L. F. Hunt	1.2	66°	Fair
San Diego, Cal.	Wilson S. Smith	1.6	76°	Fair
San Francisco, Cal.	John F. McLain	1.6	76°	Fair
Saranac Lake, N. Y.	E. E. Bellows	1.2	60°	Hilly hilly
Scranton, Pa.	O. D. DeWitt	1.4	61°	Rough
Seattle, Wash.	W. A. Wicks	1.2	66°	Fair
Sharon, Pa.	C. H. Wiltsie	1.2	66°	Muddy
Shreveport, La.	W. H. Johnson	2.1	66°	Clear
Sioux City, Ia.	Thomas Murphy	1	66°	Fair
Sioux Falls, S. D.	Knapp Brown	1.2	66°	Fair
Springfield, Ill.	H. D. Paris	1	66°	Fair
Springfield, Mass.	W. F. Anderson	.8	76°	Fair
Springfield, Mo.	H. E. Seeley	.9	70°	Clear
Syracuse, N. Y.	C. A. Young	2	68°	Rain
Utica, N. Y.	W. C. Barnhart	1	68°	Bad
Walla Walla, Wash.	R. H. Turtle	1.3	68°	Rain
Walton, N. Y.	J. H. Bryce	1.2	68°	Fair
Washington, Ia.	S. S. Smith	1.2	72°	Wet
Waterloo, Ia.	R. H. Cy	1.4	66°	Clear
Wilkesbarre, Pa.	W. S. Lee	1.2	71°	Showers
Worcester, Mass.	F. B. Williams	1.1	66°	Clear
Yankton, S. D.	J. N. Nyberg	.8	70°	Clear
York, Pa.	P. S. Pfeiffer	1.2	71°	Rough
Youngstown, Ohio	T. Stuhldreher	1.3	66°	Muddy

Every car was absolutely stock, without special attachments of any kind. No extra lubrication was employed. The sworn average consumption of oil during the run was 1.2 gal. per car. Each run was witnessed and attested by disinterested observers.

Throughout the country the severest roads known to automobilists were chosen. At Colorado Springs the route led by way of Dead Man's Canyon and Ute Pass to Cripple Creek. The finish was at the top of Tenderfoot Hill, 10,500 ft. above the sea.

In Denver, Mr. F. C. Cullen four hours after he started, was 11,500 feet above sea level. The worst roads and mountains within 100 miles of Denver were traversed and the finish was at the top of Lookout Mountain. Elevation lowers the boiling point of water, but has no effect on the cooling ability of air.

At Wilkes-Barre, Pennsylvania, Mr. W. S. Lee finished a hard run by climbing Giant's Despair, the well known testing ground.

At Pittsfield, Massachusetts, the demonstration finished at the top of Jacob's Ladder.

At Springfield, Mass., at the top of Mt. Tom.

At Kingston, N. Y., at the top of [illegible]

At [illegible] at the top of [illegible]

At Kingston, N. Y., the Catskills were climbed.

Norwich, N.Y., used three gallons of oil. The reason was a broken sight feed pipe.

Pittsburgh, Pa., and Tulsa, Okla., had temporary ignition trouble which barred them, though Pittsburgh had run 95 miles.

Beaumont, Texas, did not finish, due to running out of oil, which before noticed, resulted in burning out a connecting rod bearing. It occurred near the end of the 96th mile.

This unheard of 100-mile low gear demonstration was possible because of the direct air-cooling system of the Franklin. The primary advantages of direct cooling are: (1) nothing to overheat in hard running, (2) nothing to freeze in winter, (3) the elimination of more than 100 unnecessary parts and the amount of attention necessary, (4) sheer engine efficiency and power.

With no weight of water, pump, radiator, piping, etc., the engine is not only lighter, but less weight is required in the frame, axles, and other supporting parts.

Economy Built on Light Weight

Thus comes economy. The Franklin is easy on tires, and uses little gasoline. In the National Economy Test last May, 24 stock Franklin touring cars averaged [illegible] miles on one gallon of gasoline. The average for four years 9000 miles.

With Franklin light weight goes flexibility—resilient instead of jarring. Franklin flexibility is obtained by a chassis frame of laminated, shock-absorbing wood instead of rigid steel, by full elliptic springs, front and rear, and by the absence of strut rods and torque bars.

Not only is the superiority of Franklin direct air-cooling absolute, but upon it, it has been possible to build a car which combines highest efficiency, economy, durability, comfort and beauty.

The Standard Light Car

The dominance of the Franklin is due to fixed principles of construction unchanged through 13 years. Always easy riding, always light and flexible, it is today recognized as the *standard light car.*

Send for the striking eight-page newspaper size, illustrated supplement, with its unusual photographs, which give a panorama of the interesting features of the runs. Also booklet of telegraphic stories by men driving the cars.

FRANKLIN AUTOMOBILE CO.
SYRACUSE, N. Y.

Weights and Prices

Touring Car,	2750 Pounds	- - -	$2150
Roadster	2610 "	- - -	2150
Coupe	2890 "	- - -	2600
Sedan	3045 "	- - -	3000
Berlin	3242 "	- - -	3200

Prices are F. O. B. Syracuse, N. Y.
Ask your dealer to weigh the car for you.

batteries. In the case of mine fields protecting the channel entrances to harbors, dockyards, etc., the fields are covered by the fire of rapid-fire batteries, conveniently located on either shore.

The Submarine Vindicated

(Concluded from page 278.)

of these instruments is known as a periscope. This consists of a vertical tube which extends from above the surface of the water to a few feet within the submarine. At the top of the tube is an object glass; at the bottom an eye-piece. Two reflecting mirrors, one at the top, the other at the bottom of the vertical tube, cause the image to be transferred from the object glass to the eye-piece. The operator can turn the periscope so as to sweep the whole horizon. To the writer, who once made a five-hour trip in one of our latest boats, the view was as clear as though he were at the surface looking through an ordinary field glass. Hence when running submerged with the top of the periscope just out of the water, the navigator can see with perfect ease surrounding objects. If for any reason it should be desired to run at a still greater depth, compasses are provided by which the course may be steered with accuracy. For steering, submerged, in the vertical plane, instruments are provided which in a way take the place of the compass. One of these is a large pressure gage, which indicates the depth at which the boat is running. Another is a form of spirit level, which indicates the inclination of her axis. By the use of this, the man controlling the horizontal rudder is able to run at a perfectly even depth. While in the submerged condition, the boat is of course amply illuminated by electric lights. There are no ports or windows in the boat, and so far as sensations are concerned, one is unable to determine whether he is running on the surface or submerged.

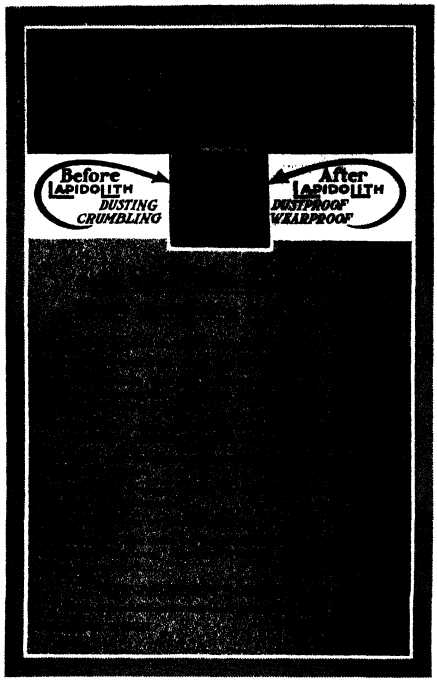
The arm of the submarine is the automobile torpedo. A number of these may be carried. They are discharged through torpedo tubes located in the bow of the boat. Any modern type of automobile torpedo may be used. In view of the fact that the submarine is enabled to approach unseen to within a few yards, if desired, of the most powerful battleship, a long-range torpedo is not required. For this reason the weight devoted to motive power in the ordinary torpedo may be largely used to increase the destructure power, so that the proper arm for the submarine would be far more powerful and destructive than the ordinary automobile torpedo.

How the War Affects the Papermaker

THE shutting off by the war in Europe of patented German dyestuffs and the cessation of rag importations from Mediterranean and far eastern ports may be expected to affect the quality of certain grades of colored papers. The simpler forms of paper stock and dyestuffs are poorly adapted for the manufacture of a tissue like blue soidlits paper, which is expected to be resistant to the action of alkalies, and for this and similar grades of fast-blue paper, rags that have been dyed with natural indigo are still preferred. Paper manufacturers who specialize in colored papers of this kind are beginning to be apprehensive of trouble in maintaining supplies.

The stoppage of dye importations is likely to affect paper manufacturers in two ways. The utmost difficulty will be experienced in producing tinted papers of a quality and appearance that have become standard of late years, because these have been made with combinations of aniline derivatives that mark the extreme of invention in chemical colors, and with the paralysis of German shipping, no less than the cessation of chemical industry in Germany, where most of these new and exceptionally fast colors are produced, no supplies can be expected to reach the United States.

On the other hand, paper manufacturers will be compensated for the loss of dyestuffs of various kinds through [illegible] Home capability in another direction. The



All-Weather Treads Should be on Every Fall Tire

Here is a tread which—when you know it—you will adopt for all wheels at all seasons. In fall and winter it's particularly essential.

It is an exclusive Goodyear feature. The tread is tough and double-thick. That makes it enduring and difficult to puncture.

It is flat and regular, so it runs like a plain tread It causes no vibration. Yet it grasps wet roads with deep, sharp, resistless grips.

In these important ways, no other anti-skid on the market compares with this Goodyear All-Weather tread

Other Things That Go With It

Here are three other features—all exclusive to Goodyears—which you get in No-Rim-Cut tires.

Our No-Rim-Cut feature, which we control It completely wipes out rim-cutting.

Our "On-Air" cure to save blow-outs. We alone employ that, at an extra cost of $1,500 daily.

Our patent method for combating loose treads. It reduces this danger by 60 per cent.

Goodyears are more than quality tires—more than the utmost in fabric and formula. In addition to that, they combat your four chief tire troubles in these four exclusive ways.

That's why more men buy them than buy any other tire. And legions of new users now adopt them every month. You will always insist on them when you know their advantages, and any dealer will supply you.



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which explains fully all you want to know about the best methods of securing and handling export trade. It is the only book on the subject, and is of incalculable value to manufacturers at this time.

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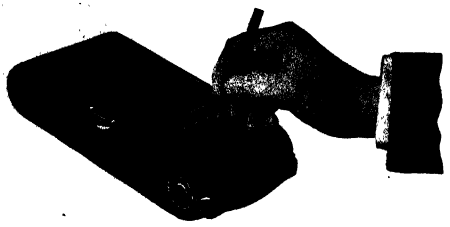
ELECTRICAL MOTORS. Their construction at Home. Scientific American Supplements 766, 767, 767, 641.

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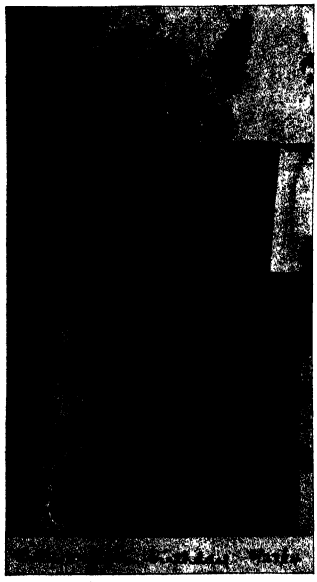
You can now date and title your negatives, permanently, and almost instantly at the time you make them.

EVERY negative that is worth making is worth a date and title. The places you visit—interesting dates and facts about the children, their age at the time the pictures were made—the autographs of friends you photograph—these notations add to the value of every picture you make. Architects, engineers and contractors who make photographic records of progressive work, can add greatly to their value by adding notes and dates permanently on the *negatives* by means of the Autographic Kodak. The amateur photographer who wants to improve the quality of his work can make notations on his negatives, of the light conditions, stop and exposure.

Just release a stop and a little door opens in the back of the Kodak; write whatever notation you want, on the red paper of the Autographic Film Cartridge with a pencil or stylus; expose from 2 to 5 seconds; close the door and you are ready for the next exposure. On the margins between the negatives will appear a permanent photographic reproduction of the notation you made. It is not a part of the Autographic plan to have this writing appear in the print itself, but simply that it be kept as a record of date and title on the negative. It is obvious, however, that it is no trouble to include it on the print when desired.

The greatest photographic advance in twenty years.

No. 3A Autographic Kodak, pictures 3¼ x 5½ in., $22.50
No. 3 Autographic Kodak, pictures 3¼ x 4¼ in., 20.00
No. 1A Autographic Kodak, pictures 2½ x 4¼ in., 17.50

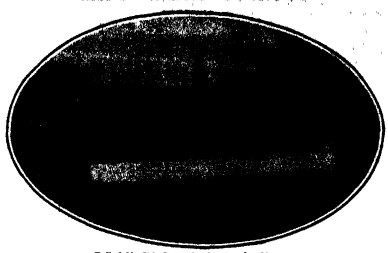


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Non-Sinkable, Self-Bailing, Life-Boat Cruiser



Pulled Up-Side-Down by Means of a Sling
Photographs taken at the test of the Holmes-McLellan Self-righting, Self-bailing, Non-sinkable Life Boat Cruiser made before the United States Steamboat Inspectors at New York

THIS 36' boat has the same lines as the United States Government Life Boats, but has a cabin instead of an open cockpit. Inside and out the boat will carry ninety persons. Equipped with 25 H. P. four cylinder Holmes Motor in stern compartment. The Government specifies exclusively for use in the 36' power life boats of the Life Saving Service the 35-40 H.P. six cylinder Holmes motor. *Non-Sinkable*, speed 9½ miles per hour, should be carried on every big government and commercial vessel. Patent allowed in the United States.

THE HOLMES MOTOR COMPANY, Inc.

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Released from Sling, Righted in Ten Seconds, Cockpit Free of Water in Less Than a Minute



One of Every 7 Men is Killed or Injured by Accident Each Year. *Which Will It Be?*

YOU may be the one. Your chance is no better than those of the other six. Protect yourself and your family now—while you can. Three cents a day will do it if you are in a "Preferred" occupation. The cost of a couple of newspapers brings $1,250 to $3,250 in case of death by accident, $5 to $10 weekly income, $1,000 to $8,000 for loss of two limbs or eyes, $500 to $1,500 for loss of one hand, foot or eye, $250 for death from any cause. Larger amounts at proportionate cost.

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You Get a Weekly Income when Disabled by Accident

It isn't only railroad wrecks and shipwrecks and falling elevators you have to fear.

One man was hit in the eye by a snapping rubber band. It put him in bed for six weeks. He was Ætna-ized, so he drew his weekly indemnity.

One man was struck in the head with a baseball. He had to have a surgical operation and was unable to leave his home for three weeks. He drew his weekly Ætna benefit and Ætna paid for his operation.

One man tripped on a flight of stairs, fell, broke his ankle, went to bed for 2 months. He was Ætna-ized so he drew a weekly income and turned his hospital bill over to Ætna.

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trend of taste and vogue, colors, the origin of which are so attractive, used in the manufacture of the best grades of bank, ledger, and writing papers, will be compelled to fall back on simpler dyestuffs of less enduring tints. Owing to the increasing use of the more complex and permanent dye compounds, papermakers have found it impossible to use a great variety of rags that was once available. The reason is that nearly all of the finer qualities of modern shirt material, skirtings, etc., are dyed with coal tar dyes, which are exceedingly resistant to bleaching agents. It will be readily understood, therefore, that any extended interruption of supplies of these dyestuffs is likely to cut two ways. It would hamper the papermaker in producing colored papers of a brilliancy and permanency that have become popular of late years, but it would, at the same time, open up to him plentiful sources of rag supplies that could be easily treated to yield fine white paper pulp.

The Dumdum Bullet

THE wide publicity given in the public press to the accusations that the various nations now in conflict in Europe have been making use of "Dumdum" bullets brings out the fact that very few people know what a "dumdum" is, and what is more to the point in the present circumstances, fewer still have any idea of the widely varying character of gunshot wounds.

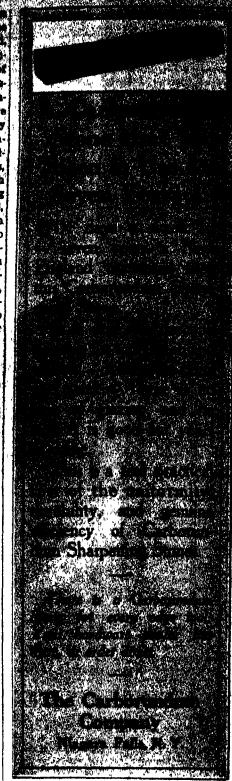
During the Chitral campaign in India, in 1895, the native troops found that the nickel-jacketed lead bullets they were using were not as effective as they wished; that is, they did not "stop" their man. They found the difficulty could be overcome by partially stripping off the nickel jacket and exposing the leaden head. These bullets, because they came from the Dumdum Ammunition Works, at Calcutta, were known as "dumdums." They became greatly distorted when striking a soft body, spreading out into something like a mushroom shape and producing a very serious wound

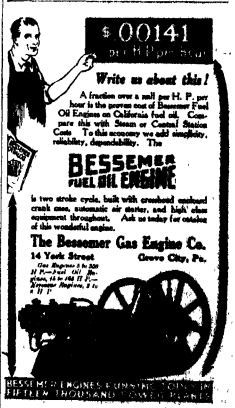
This is the true dumdum bullet. It will be appreciated that, as in the Indian campaign, the bullet can be easily prepared by any soldier individually, without the knowledge of his superiors; and if such bullets have been used in the present war, this is their undoubted source. In view of facts to be stated presently in relation to wounds made by modern bullets, there is little object or reason for any government intentionally supplying this form of ammunition.

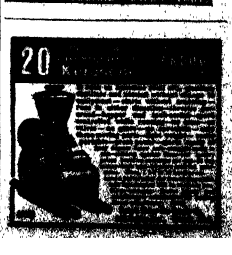
For a long time hunters of big game have been aware of the deadly qualities of a bullet that would spread out or "mushroom" quickly on striking its target, and to insure this result with certainty many special devices have been introduced, such as bullets with a hollow, cup-like head, or a similar bullet combined with a plug of harder material, which, being forced into the softer lead by the impact, would quickly spread out the body of the bullet. It is evident that any soldier so disposed could, in addition to stripping the jackets from his ammunition, make a little hollow in the tip. Even a nick would have more or less effect.

But quite apart from this question is the fact that the nature of the wound would be no indication to the ordinary observer of the character of the projectile that produced it. In fact, in many cases the result might well deceive an experienced practitioner, for the modern bullet is capable of producing many entirely unexpected results.

Under many conditions, when the high-speed, small-caliber bullet used in modern rifles strikes a man, it makes an exceedingly small puncture, and passes through both bone and tissue alike, with trifling injury. Although the man is incapacitated for the time being, he suffers no permanent injury. This is what was aimed at when the small caliber rifle was adopted. Unfortunately, the bullet does not always act in this way, for the so-called "Spitz" bullet, which has been introduced in Germany and adopted by several other countries, behaves in a most







[illegible] it will be necessary to invest a considerable amount of capital to manufacture under the patent, in a commercial manner, and whether it will be necessary to grant rights for a considerable term in order to interest sufficient capital to undertake the enterprise.

The probabilities are that all license fees will be collected by the Board of Trade to be retained until the termination of the war.

The Current Supplement

IN the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2022, for October 3rd, will be found an interesting account of the use of searchlights for war purposes, especially as developed in France. An unusually valuable article to those interested in the manufacture of iron, and the facts given in which are also undoubtedly applicable to a considerable extent in other lines, is Electric Driving for Rolling Mills, which gives facts and figures as to the application of the system to mills now using steam drive, and shows remarkable economies in both cost and space. Recent Developments in Marine Propulsion reviews the history of the turbine, and tells how it is now applied to secure both economy and efficiency, and also has something to say about the Diesel oil engine. The history of the Automobile Torpedo will interest everyone in view of the recent sensational use of this comparatively little known war engine. The problem of controlling big ocean steamships is always a vital one, and the description of the Westinghouse Bridge Control indicates a wonderful advance. By means of a comparatively simple combination of devices, operated by compressed air and oil under pressure the officer on the bridge is enabled to start, reverse, or stop the turbines which drive the vessel, and to regulate their speed, as occasion requires. It is a most ingenious and valuable device which has proved its efficiency in practical tests on the U. S. collier "Neptune." The Experimental Plotting of Electro-Static Fields covers a subject which is explained by its title, and has a practical as well as an experimental interest. Wireless Equipment of Aircraft describes in simple language that can be understood by anyone how wireless messages are sent, and tells of the difficulties of operating to and from aircraft. Birds and the weather discusses theories connected with the migration of birds. A review of a new atlas of Finland gives much interesting information about an attractive country of which we know but little. The address on Heredity, by Prof. Bateson, is concluded in this issue; and there is the usual assortment of smaller but valuable articles.

Salt and Microbes

SALT is generally thought to be fatal to microbes, because it serves to keep perishable food substances, but from an absolute standpoint, this is quite an error. For instance, the typhus bacilli, that of "rouget" of the pig, or of tuberculosis, can be placed for several weeks in brine, and thrive all the better. Besides, it should be remarked that blood contains salt, and this does not prevent microbes from multiplying upon proper occasions. Certain changes seen in salt fish, for instance, in codfish, come directly from microbes brought by the salt itself. For, in fact, the salt as it is prepared in the salt marshes is far from being sterile, and Dr. Rappin of the Nantes Pasteur Institute was able to count no less than 30,000 bacteria per cubic centimeter in the concentrated brine from which the salt is deposited. After the salt is placed in piles, it undergoes numerous grindings in which hygiene is entirely lost sight of. Thus he finds that far from being antiseptic, salt of that kind, and no doubt from other sources, needs to be put through an antiseptic treatment. Such could be done by a strong heat in a closed vessel, or by washing it with a hypochlorite of soda solution. Unfortunately, such operations would be difficult to carry out in practice.



Quite a difference in your plant when walls and ceilings are covered with Rice's Gloss Mill-White.

Do you get only 1/500 of your proper light?

Do you want to *reduce* your expense of production?

The amount of daylight in a plant has a direct effect on this expense. One firm found that the expense of production rose 20% when artificial light had to be used. The reason why is plain. Employees work better when they can *see* better.

Illumination engineers say that the light in many plants is only 1/500 to 1/1000 of the strength of pure daylight.

If you paint your walls and ceilings with Rice's Gloss Mill-White, you will get the maximum amount of daylight possible in the plant. Rice's Mill-White results in from 19% to 36% more daylight, because it *reflects* light, instead of absorbing it. It cuts electric lighting bills heavily. (See the Knotair Hosiery Co. letter below.)

Over 3,000 firms now use this interior finish. Rice's requires *less frequent repainting* since it remains white longest. And it is highly sanitary,—it can be washed with soap and water without killing the gloss.

RICE'S GLOSS MILL-WHITE

is *guaranteed to remain white longest*. Many imitations have lately sprung up, and they may *appear* as well when *first* put on.

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This is our guarantee. If Rice's Mill-White does not remain white longer than any other gloss paint—applied at the same time and under the same conditions—we will give, free, enough Rice's Mill-White to repaint the job with one coat. We guarantee also that, properly applied, Rice's Mill-White will not flake nor scale. You cannot lose under this guarantee.

Write for fuller information and sample board.

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On inside concrete, Rice's Granolith makes the best possible primer for a second coat of Rice's Gloss Mill-White,—giving a tile-like enamel finish at no more expense than lead and oil paint.

U. S. GUTTA PERCHA PAINT CO.
23 Dudley Street, Providence, R. I.

What a Few Users Say

Sanitary conditions in our plant have improved wonderfully. We should judge we are getting 50% more light than before.—Mellen's Toasted Corn Flakes Co., Battle Creek, Mich.

We are indeed astonished to note the vast amount of daylight created by this paint; especially where we were formerly forced to use electric lights all day. Now find it entirely unnecessary. Agreeably surprised to observe a how easy it is to keep clean.—Knotair Hosiery Co., Philadelphia, Pa.

The most practical interior finish we have ever used on walls and ceilings. We imagine we will show an increase of between 25 and 30% in light.—H. J. Heyrman & Co., Tobacco Co. (Makers of Prince Albert.)

Find it very satisfactory indeed.—Illinois Safety Razor Co.

The best thing we know of.—H. Dudgeon's Sons, Poughkeepsie, N. Y.

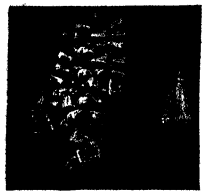
Out of six comparative tests, Rice's Mill White leads.—Killingly Mfg. Co., Killingly, Conn.

British Patents and the War

THE "revocation" of British patents granted to German and Austrian subjects has aroused in many fair-minded people a feeling that the British government has gone to great extremes to punish subjects of the powers with whom it is at war. But a careful investigation of all the facts prompts one to believe that the first thought in the enactment of the law which has created so much resentment has not been to deprive the Germans and Austrians of their patent rights in Great Britain, but to prevent an interruption in those industries which are carried on wholly or partially under patents owned in Germany and Austria.

The statute amending the British Patent Act under which the patent rights of subjects whose countries are at war with Great Britain may be interfered with, provides for the "avoidance or suspension in whole or in part of the patent or the license granted." Under the rules provided by the Board of Trade for carrying out the provision of the statute, a patent owned by a German or Austrian subject can be interfered with only by making application for the "avoidance or suspension" of the patent. When such an application is made, the Board of Trade will decide to what extent property rights in the patent in question must be interfered with to permit the continuation of manufacture under conditions as normal as possible. But, in addition, the Board of Trade will determine whether the applicant must pay a license fee for the right to use the patent. While the word "royalties" in the statute means the ordinary royalties, for the most part, it may be left open to the commission of the patent to fix the amount of payment which should be made to the [illegible]

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RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Aviation.

COMBINATION AEROPLANE AND DIRIGIBLE BALLOON.—A. E. MUELLER, Los Angeles, Cal. This aeroplane is fish-shaped as viewed from above, consisting of a main plane of oval form, and an auxiliary plane fore and aft. Above the main plane is a rectangular plane. The main plane and the rectangular plane are provided with panels capable of being tilted as desired, to provide stability. The fore and-aft planes are also movable, for the purpose of stabilising and steering the aeroplane The machine is provided with a propeller fore and aft, also a series of bladed wheels with their upper halves housed so that they will operate to propel the aeroplane on the principle of the paddle wheel. Provision is made for combining with this machine an elongated balloon.

Electrical Devices.

TESTING LAMP AND FUSE TESTING DEVICE.—C. W. MITCHELL, 513 Twelfth St., Brooklyn, N. Y. This invention has for its object the provision of an improved testing construction which may be adjusted or rearranged to accommodate varying circumstances, and for testing conductors of electric circuits under varying conditions It may be used at one time in series with a circuit and at another time in multiple series.

WIRE REEL.—W. E. EICHHOFF, care Mary E. Eichhoff, Azusa, Cal. This improvement is more particularly for use by the linemen of telephone, telegraph, and electric light companies, in which ample strength is required to support the weight of heavy coils of wire, especially when the reel is so disposed as to turn on an approximately horizontal axis for reeling or taking up the wire.

Of Interest to Farmers.

HARROW.—O. L. MCKINLEY, care of McKinley Bros., Demopolis, Ala The present invention refers more particularly to sectional harrows, the object being to provide a sectional harrow in which each section is so constructed that a plurality thereof may be selectively assembled without regard to rights or lefts, or fronts or rears

CULTIVATOR TOOTH.—R. E MCQUILLEY, W. G. HEA, and D B FOWARD, Cedarville, Modoc Co., Cal. Among the objects here is to provide a cultivator tooth of peculiar construction and adaptation, the same being detachably connected to a cultivator post in such a manner as to be capable of reversal from one end to the other, whereby the efficiency of the tooth is increased

SEED GRADING MACHINE.—E. W. VAN FLEET Evart, Mich. The purpose of this invention is to provide a simple, cheaply constructed, and easily operated machine, especially designed to separate seeds into different sizes and to polish and clean the said seeds during the separation of the same into their respective grades.

Of General Interest.

GUTTER HANGER.—C. W. WILSON, care of Archer & Wilson, Medina, N. Y. The invention relates to gutter hangers or supports, the more particular purpose being to provide a gutter hanger and gutter to be supported thereby, these parts being of such form that the gutter when mounted in position upon a building has the appearance of a cornice, and is otherwise ornamental.

EGG CARRIER.—I. V. BOWLEY, 19 Friend St., Taunton, Mass. This invention relates to packing or shipping receptacles and has particular reference to partitions or fillers for receptacles intended for the transportation of eggs, bottles, electric light bulbs, or other fragile articles Among the objects is to provide a filler of a simple, cheap, and reliable nature

WIRE HOLDER.—S. E. ELLIOTT, West Salem, Ill. This device is especially adapted for handling wire fencing during the stretching thereof, and wherein means is provided for permitting the clamping bars that engage the fencing throughout its height, to be easily and quickly placed on the fence or to be removed therefrom, without the necessity of removing or replacing taps, nuts, and the like.

WIRE FENCE CLAMP.—E. B. WELLS, 135 Eleventh St, Miami, Fla. This clamp is utilised to clamp wire fencing, for attachment with any suitable device whereby the fencing may be pulled tightly along and against the posts in erecting a fence, and the aim is to provide a device which comprises quick detachable members for diagonal engagement with the wire fencing and for connection therethrough.

HOLDER FOR AN INSECTICIDE.—M. MCKAY, care of Fore & Co., Inc., Rockhol, N. C. In carrying out this invention, Mr. McKay preferably employs two receptacles, or bags, which are constructed of fabric that is permeable to the powder, the inner bag having a coarser mesh than the outer one. And he provides the inner bag with an elastic or spring distender adapted to prevent the bag's collapsing in consequence of the discharge of a large portion of the insecticide powder.

FRUIT STAND.—O. ROGERS, Bonham, Tex. This invention is an improvement in fruit-

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stands, and has for its object to provide a stand of the character specified, in the form of a receptacle for holding fruit, so arranged that while the fruit may be freely inspected, it cannot be removed from the receptacle without opening the same

HORSE COLLAR PAD.—D. L. WILLIAMS, care of Ord, Nebraska Valley Co., Ord, Neb. By means of the pad the collar opening may be varied in size to fit the necks of different horses. The aim of the invention is to provide an inexpensive, simple, and efficient pad for a closed horse collar whereby the same can be adjusted to fit the necks of different horses

PHOTOGRAPHIC CAMERA.—A. VORIS, 15 Cottage St., Jersey City, N. J. This invention relates more particularly to that style of camera in which the image formed by the lens is focused upon a screen at the front of the plate-holder and is observed by the operator through a suitably located aperture in the camera box.

PULLEY AND LOCK FOR CABLES.—A. J. HAGAN, 809 Ninth Ave., New York, N. Y. This invention relates particularly to a pulley and lock for clothes lines. The object is to provide a structure in which the clothes line will be properly held in position and locked against movement when the line is slack, but will be permitted a free movement over the pulley when the line is taut

AGITATOR AND FILTER FOR TREATING ORES.—J. D. FIELDS, Manville, Mont. An object here is to provide an apparatus which may be used for the leaching of ores or bringing their metallic content into solution with the use of acid, corroding gases, or corroding alkalis without necessitating any alteration of the apparatus.

BRUSH.—J. MORRISON, JR., 2½ Gage Ave., Glens Falls, N. Y. The invention relates to improvements in brushes, and the object is to provide an improved structure which is adapted to properly fit the hand so as to be readily retained in the grasp. Another object is to provide a brush with a light and substantially waterproof back

MANUFACTURE OF INDUSTRIAL OBJECTS FROM VOLCANIC OR OTHER FUSIBLE ROCK.—F. RISSE, 26 Avenue de la Gare, Mauriac, Cantal, France. This process is distinguished from previous processes for the manufacture of articles from volcanic rocks or other minerals by melting and molding said rocks or minerals, the distinction being due to the fact that the rocks or minerals are, after fusion and molding, but before their temperature falls below 500 deg. Cent., placed in a reheating furnace, heated to about 800 deg. Cent., and remain at this from half an hour to an hour and a half, according to size, and are then cooled very gradually

HOT WATER DISPENSER AND DRINKING GLASS STERILIZER.—J. J. OLLIETTI, Plattsburg, N. Y. This invention is especially adapted for use in bar rooms, restaurants, drug stores and like places, where drinks are sold to the public, whereby the glasses or other drinking vessels can be easily, quickly, and effectively sterilized and hot water dispensed where such is necessary for the preparation of hot drinks.

DISPLAY COUNTER.—E. FRIEDRICH, 802 E. Commerce St., San Antonio, Tex. This invention relates particularly to grocery counters having a series of drawers at the back thereof, and more especially to a novel form of sample containers, and means for supporting and removably retaining the sample containers at the front of the counter

RING SETTING.—HATTIE A. DAVIDSON, care of John J. Smith, 71 Wall St., New York, N. Y. This invention relates to jewelry, and particularly to a combination ring setting and locket or lavalliere, and has for an object to provide an improved setting which may be quickly and easily applied to a removable ring and also quickly removed from a supporting chain.

SUSPENSION ROOF.—C. BUTLER, 1170 Broadway, New York, N. Y. This roof is designed to inclose areas large enough to accommodate circuses, fairs, field meets, baseball, football or other athletic games, whereby such events may be held in all kinds of weather or at night by the provision of suitable lighting facilities which may be supported from the roof.

PRINTING FRAME.—H. COHN, 2110 Hughes Ave., Bronx, N. Y. N. Y. This invention provides a frame having upper and lower frame members, hinged at one end, there being a spring for raising a glass member relatively to the lower frame member, so that a print may be conveniently slid off the glass, the glass being normally held down, and in the lower frame member by back members and clamps on the upper frame members. These back members are prevented from falling through the upper frame member by the hinges, which extend laterally and are adapted to rest on an inner flange on the upper frame member.

HAND PUMP.—A. C. STIEGEL, ROSSIE, LA. The purpose here is to provide a pump for use in transferring liquid from one receptacle to another, or for bailing out boats and the like, wherein a light, compact, and easily transported device is provided, capable of being held in one hand and operated by the other, or in any other suitable manner.

MOLD FOR FENCE POSTS.—E. P. BAUM, Box 81, Keokuk, Iowa. In this invention the improvement has reference to a mold formed in sections and having novel co-acting members at the portions to hold in place wire-holding

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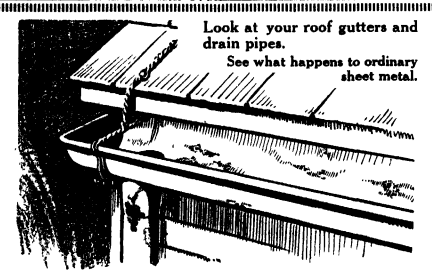
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elements during the molding process, to incorporate said elements in the molded post.

METHOD OF PREPARING LITHOGRAPHIC STONES.—H. Bucck and W. Schumbach, care of the Barnes, 155 Napoo Ave., Woodhaven, N. Y. This invention provides means for registering a tinting screen of the "Ben Day" type upon successive stones employed in lithography; provides means for avoiding the production of "pectures" when using a tinting screen in lithography; and reduces the expert-labor factor in preparing stones for lithographic printing.

Hardware and Tools.

TENT PEG.—W. G. Strausman, Jr., U. S. M. Recruiting Station, 161 Griswold St., Detroit, Mich. This invention provides a peg having means for anchoring the same in the ground, thereby preventing the withdrawal of the peg until such time as it is desired. In this peg the anchoring means may be withdrawn into the peg, thereby permitting the peg to be readily pulled up.

GRASS TRIMMER.—C. Nystrom, 1629 Plymouth St., Westchester, Bronx, N. Y. This invention provides an arrangement of relatively reciprocating cutters, whereby the cutting edges will be maintained in contact so that the grass will be effectively cut without liability of the cutter becoming choked, the operating mechanism for the movable cutter or blade including means whereby the blades are maintained in cutting contact.

TOOL HOLDER.—J. H. Frank, 144 Clinton Ave., Brooklyn, N. Y. An object in this case is to provide a device for holding tools in the most advantageous and practical positions. And further to provide a device in which the removal or replacement of a tool for reshaping or for other purposes is greatly facilitated.

SPACER BOLT.—G. Cousins, 75 Ellen St., Oswego, N. Y. By means of this bolt, walls, as for instance the walls for concrete forms, may be held in spaced relations by means of a single bolt, which engages both walls positively, and firmly holds the two walls from lateral movement to—d or from each other. It is so arranged that the bolt may be applied and moved, in a minimum of time and with a minimum of labor.

Heating and Lighting.

OPERATING MEANS FOR ELECTRIC LAMP SWITCHES.—A. J. Tilley, care of H. F. Caldwell & Co., 88 W. 15th St., New York, N. Y. This inventor provides a rotary lamp switch member with a stud movable in a slot in a casing by a cam mounted on a collar so that the switch member may be rotated a distance by the collar and the cam, and with a further rotary movement of the collar the cam may push the stud into a recess at the slot, which permits the cam to pass the stud. The switch member may be then moved back to normal position by a spring. The rotary switch member having the stud may be connected with an electric switch of a well-known type.

Household Utilities.

STOVE.—C. A. Wilkinson, 39 King St., Worcester, Mass. This invention relates particularly to family gas ranges or ovens, and what is known as bakers' ovens, and has for an object a construction whereby the heat is retained and more evenly distributed. The stove is formed with an oven having a top and bottom construction of reinforced concrete.

VACUUM PRODUCING APPARATUS.—F. A. Weimann, care of Fischer, Sweeney & Brough Co., 1302 Clinton St., Hoboken, N. J. This improvement provides an apparatus more especially designed for use in vacuum cleaning systems and arranged to readily draw air and dust through the house pipe to stime the dust and separate the air from the stimed dust, and to permit of using the water for stiming the dust over and over again.

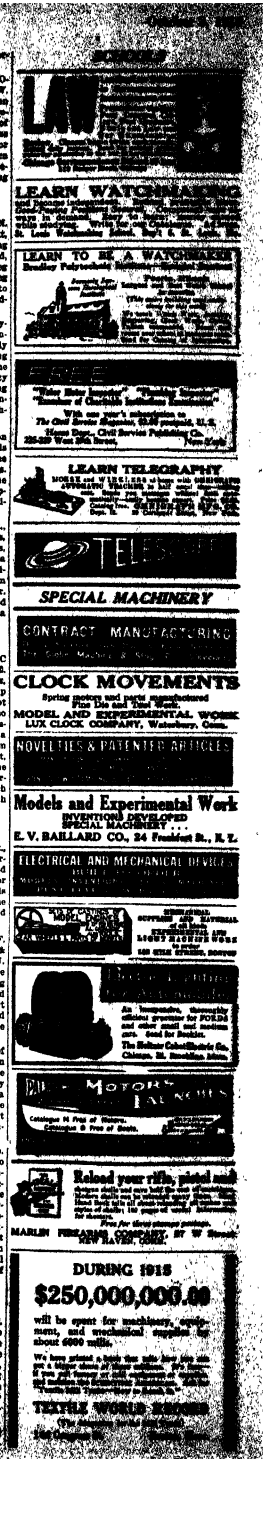
WALL HEATER.—G. F. Reesor, care of Reesor Mfg. Co., Mercer, Pa. This invention more particularly relates to gas heaters of the type known as wall-heaters, and is especially intended for use in bathrooms. It provides a heater the body and frame of which will be kept below a temperature at all liable to set fire to the walls in which the heater is installed.

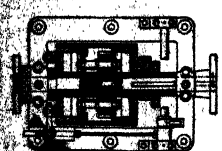
BED.—T. H. Soblen, 116 Eighth St., So. Minneapolis, Minn. This invention relates to a bed that may be raised into a ceiling opening, and it provides a sprocket chain connection between the crankshaft and the upper side wall shaft in order to do away with the vertical side wall shaft, and also provides a structure around the ceiling opening and co-operating with the false ceiling part, whereby to at once conceal the latter from observation when the bed is lowered and permit of its vertical movement without the necessity for the use of limiting chains.

Machines and Mechanical Devices.

GUIDE FOR SEWING MACHINES.—F. F. Dennison, 61 Central Ave., Pequot, N. J. The guide is mounted on the bench opposite the feeding side of the machine for guiding the piece of goods to the hemmer of the machine, the guide being arranged to permit of moving it away from the feeding side of the machine to allow convenient access to the machine for removing the machine from the bench for repairs or other purposes.

PNEUMATIC PUMP.—A. J. Stewart and C. C. Swanson, Address, Bethany, Mo. Assignors





BRAKING DEVICE FOR REFRIGERATOR CHAIN MECHANISM.

...ented into contact with the drum at all points on its periphery when actuated and when free from the drum it may spring entirely away from the drum.

ROPE HAULWAY.—T. TSCHEBABY, Rosegergasse 19, Leoben, Styria, Austria-Hungary. Carrying ropes form two groups side by side whereon the trolley carrying the car runs, the car being suspended between the groups. Means support a guide rail which projects above the ropes and raises the car from, and guides longitudinal displacement of the same. On the standards freely movable grooved rings guide the carrying ropes and are themselves guided on the standards by rollers. Means provide that if one carrying rope breaks the corresponding rope of the other group is simultaneously untensioned while the remaining ropes remain tensioned. In addition to the traction rope which is detachably connected with the car, is a second which connects the ends together and at the stations alone connects the cars, released from the former traction rope, from the incoming onto the outgoing track.

Pertaining to Vehicles.

AUTOMATIC OIL INDICATOR AND FEEDER.—C. E. HENKELMAN, 2213 Pacific Ave., Atlantic City, N. J. In carrying out this invention, Mr. Henkelman avoids several objections by providing an indicator and feeder, wherein the operator will be informed at all times of the quantity of oil in the motor, simply by inspection of an indicator located at the dashboard, in which, when the oil recedes to a predetermined level, oil will be automatically supplied from a reserve tank and the supply cut off upon the oil's reaching such level.

SUPPLEMENTAL TIRE.—L. KEMAN, Totten, Net. This invention relates to supplemental tires for wheels of wagons or other vehicles except such as run on rails or are equipped with pneumatic tires. The tire may be readily attached to or removed from the wheel and is provided with a calk for preventing the skidding of the vehicle on slippery roads.

GARDEN TRUCK-BURNER BARROW.—T. TRAVIS, Groton, Long Point, Conn. This barrow can be readily wheeled about and used either for carting purposes or for burning garden trash at any point in the garden without danger of setting fire to surrounding objects and at the same time avoiding tedious carting of the trash to a separate burner at a distant point.

Designs.

DESIGN FOR A BROILER GRIDDLE.—S. RENEWANSER. Address Ross Boiler Co., 111 South 3rd St., St. Joseph, Mo.

Notes.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

We wish to call attention to the fact that we are in a position to render competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialized mechanical, or industrial knowledge required therefor.

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NEW BOOKS, ETC.

THE SCIENCE OF SOME CHEMICAL BIOLOGICAL AND ON CELL LIFE. By Chave E. Spaeleth-Hamberton. Acton, Ontario: The Acton Free Press, 1914. 8vo.; 60 pp.; with plates.

We are given in this slim volume some interesting speculations based upon the researches of Lowig, Lodge, and other investigators, supplemented by the author's own studies. We fail, she holds, to understand the construction of the cell-wall, because we ignore the intervening substance between the nucleus and the wall. The origin of living cells, she maintains, must be looked for "at the place of decomposition and reconstruction of electric charges into primal ether, this ether taking the place of exhalation and inhalation, or the breath of life"; and the basis of vital processes is "the fixed combination of different kinds of electric charges, making up a definite number of atoms, all containing the same weight, but representing different positions in space, because of different degrees of expansion, or conditions of 'tension.'" It is a work difficult to appraise and impossible of summarization in a short review.

THE SCIENCE OF BILLIARDS. With Practical Applications. By J. T. Stoddard. Boston: W. A. Butterfield, 1913. 8vo.; 160 pp.; with diagrams. Price, $1.50 net.

Billiards, a game so essentially dependent upon science and skill, is worthy of wider interest and interpretation than has hitherto been accorded it. The volume in hand is a welcome addition to the scant literature of the game, and imparts a very good knowledge of the complicated factors entering into the play. The behavior of the balls under the different shots—caster, follow, draw, side, picqué, and massé strokes—is analyzed in a masterly manner, and both student and practised player may profit by the principles imparted and the additional control thereby gained.

STEAM TURBINES. A Practical and Theoretical Treatise for Engineers and Designers. Including a Discussion of the Gas Turbine. By James Ambrose Moyer, S.B., A.M. New York: John Wiley & Sons, Inc., 1914. 8vo.; 376 pp.; illustrated. Price, $3.50 net.

Steam turbine development of the past few years is notable for size increase, and is marked by a tendency to reconcile two, three or four types. Only three years ago the largest turbine-generator was rated at 14,000 kilowatts; to-day we have the 35,000-kilowatt generator. Prof. Moyer's work in this, its second edition, has been considerably extended and improved. Among new material we find discussions of bleeder or extraction turbines and mixed pressure turbines. Other additions are evident in the chapter on low-pressure turbines, as also in many others. New calculations have been made, and the result is an entropy-heat chart embodying the very latest data on superheated and saturated steam. The gas turbine is touched upon, and the difficulties attending its practical development are briefly sketched. An appendix contains examples relating to steam turbines, which are to be worked out by the student.

MODERNE PROBLEME DER PHYSIK. Vorträge von Dr. H. Slevekling, Professor an der technischen Hochschule Karlsruhe. Braunschweig: Friedrich Vieweg und Sohn.

The Mannheim Section of the Verein Deutscher Chemiker decided in 1913 to inaugurate a series of lectures for the purpose of instructing its members in the many recent achievements in theoretical chemistry and physics, with special reference to the later work which has been done in electricity. In five lectures Dr. Slevekling gave the Mannheim chemists a very complete review of the work which has been done within recent years. This book is a republication of these five lectures. Written in a fairly popular style, they ought to be highly instructive to those interested in science and who wish to keep abreast of the times. They discuss in a very instructive way modern electronic theories, radio-activity, progress in thermo-dynamics, Roentgen rays, electro-dynamics, as well as the principle of relativity.

MANUEL PRATIQUE DE FONDERIE. Cuivre. Bronze. Aluminium. Alliages Divers. Par J. Dupenchelle, Ancien Directeur de Fonderie. Paris: H. Dunod et E. Pinat, 1914. 8vo.; 268 pp.; illustrated. 6 francs.

French foundry practice is herein set forth somewhat exhaustively. The text is replete with illustrations of installments, utensils, and machines and accessories of every description. Useful forms and tables close a very good index go to the completion of a handbook that will appeal generally to owners, managers, and students who have a reading acquaintance with the French language.

A POCKET MAP OF THE RIVER THAMES, FROM OXFORD TO RICHMOND. Showing the Towns, Bridges, Locks, Towpaths, Ferries, etc. With Distances from Oxford. London: The Homeland Association, Ltd. 16mo. Price, 1s. net.

A dainty little frontispiece shows the lock at Sandford-on-Thames. The sectional maps are on a scale of one inch to the statute mile. There are hints and rules for river conduct and brief descriptions of the points of interest.



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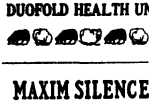
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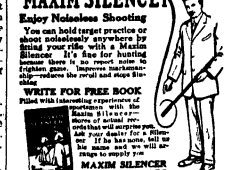




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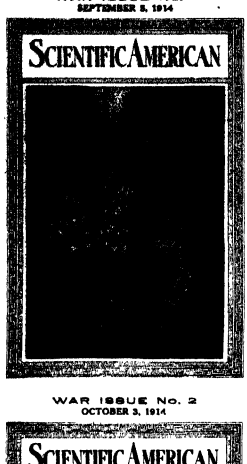
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Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(13023) H. Z. asks: Kindly let me know through your magazine the distance round the earth six miles above the equator, if possible; if not, the length of the equator. A. The equatorial radius of the earth used by astronomers in their calculations is 3,963.296 miles, or 20,926,928 feet. With this number you can find the circumference of the earth six miles from the equator. We are not able to give the time for the solution of mathematical problems for our esteemed correspondents. The radius of the circle of the parallel of latitude six miles from the equator would be about 24 feet shorter than the radius at the equator. If you would find it more exactly, you must employ trigonometry.

(13024) E. E. S. writes: An unusual combination of natural phenomena occurred shortly after 4 o'clock yesterday morning (July 8th). The sun was just rising while the moon was still visible in the west, a thunder storm was in progress, and a rainbow was also clearly visible in the sky. The sky was wonderful! The rainbow was southsouthwest, with the black storm cloud rising behind it, while in the east the sky was golden, suffused with pink, from horizon to zenith. The preceding day had been the hottest of the year. Now I want to thank you for your sky maps. With their help I have learned to know all the first magnitude stars and have followed the constellations on their way from east to west for a year, and feel that I have a bowing acquaintance with Mars, Saturn, Venus and Jupiter. As I am forty-five years past the latter end of my school days, I feel quite "set up" with my attainment. A It is quite unusual to see such a combination of natural phenomena at so early an hour. Most people are abed at that time. It is pleasant to receive so hearty a testimonial of benefits received from our columns

(13025) R. W. asks: 1. Is it a recognized law of meteorology, or is it simply due to chance, that local showers seem to follow in the same path some seasons, and to avoid places where there had not been rain for some time? It seems that some parts of a country, for instance, will have three or four good rains, while a strip of country five or ten miles away will have light rains or none at all. Have scientific observers ever noticed this apparent tendency of rains to follow the same path for some time? A. The occurrence of several seasons in succession with similar weather, as wet or dry, cold or warm, has been noticed by meteorologists, but no law to explain the fact has been detected. 2. Also, do small lakes receive more rainfall than the surrounding country, on the average? A. It is not probable that more rain falls on a small lake than on the land surrounding the lake. We see no reason why such should be the case.

(13026) E. C. L. M. asks: In connection with the letters and discussion on scientific writing and scientific terms, I wish to call your attention to a question and answer in the question column of a periodical. Question: "Can you say 'the flying machine is afield' when it is in the air?" Answer: "If an aeroplane were on the practice ground, it should be characterized as being afield, but if it were in the air, it should be characterized as being afloat, that is, as floating in the air." Afloat is evidently not the term to use, as an aeroplane does not float. What would be a better term? A. We should not object to the use of the word "field" as describing the region in which an aeroplane is moving. As well object to the use of "flying," since these machines glide rather than fly. We think it was Longfellow, in a poem beginning "How beautiful the rain!" who used the expression "fields of air," and represents Aquarius as flying through the fields of air. We agree with you that aeroplanes do not float. They are far from being floating machines.

(13027) D. F. B. writes: In the answer to question 12988, in the issue of May 2nd, 1914, you state: "A vertical line is one which passes from the center of the earth to the zenith of any place." While the conclusion of your explanation answers the question correctly, the statement quoted above is not correct. The earth being an ellipsoid, or very nearly so, a vertical line is tangent to the revolved curve generating ellipse, and does not touch the center unless it is drawn through a point on the equator or through the poles. A. You are quite correct in your criticism of the answer to Query 12988, but the difference is, we dare say, not perceptible to the naked eye. It would have been better for the purpose of the inquirer to have said the line passing from the zenith through the observer. Then the critic would have said that the observer's horizon is not a line. This question came, as we remember it, from two workingmen who were having a discussion and asked our decision. How much could they have made out of the definition that a vertical line is tangent to the evolute of the generating ellipse of the ellipsoid of the earth's surface? If so many astronomers believe, the equator is not a circle, then the earth is not an ellipsoid of revolution, and what is the definition of a vertical line then? Sometimes it is easier not to be too technical.

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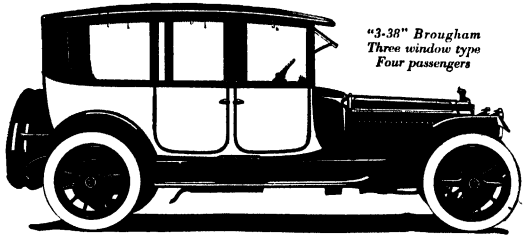
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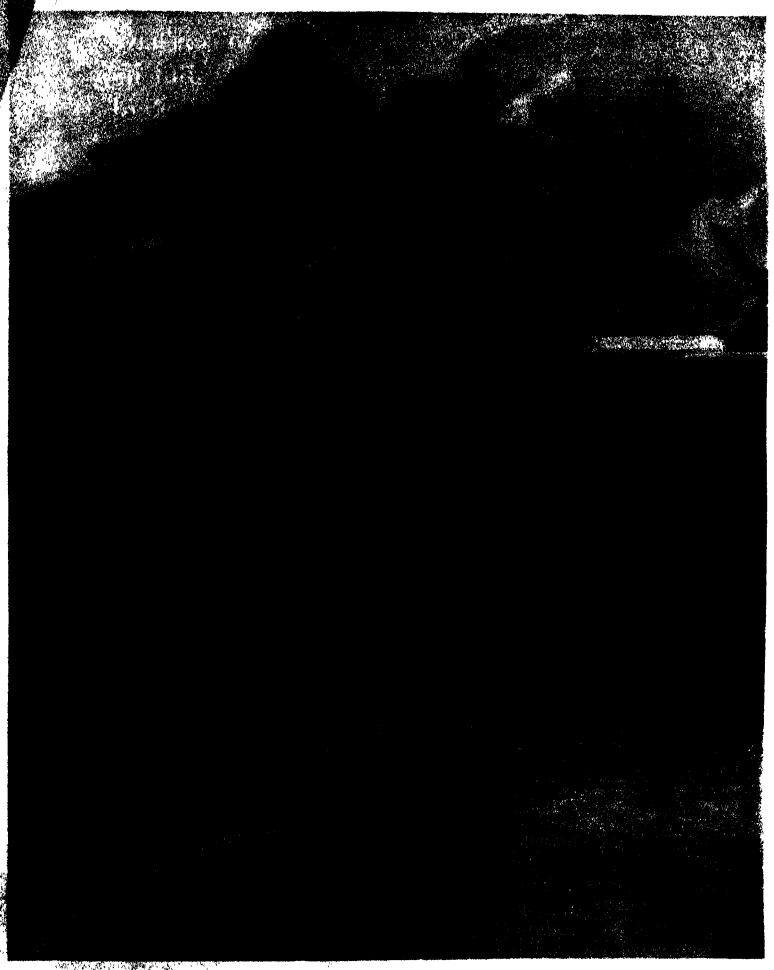
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SCIENTIFIC AMERICAN



Vol. CXI. No. 18
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Price 10 Cents
$3.00 A Year

HUDSON Six-40 $1550

$3,875,000 Last Month Paid for Hudson Sixes

$930,000 Weekly

These figures tell better than words can how men are flocking to this new-day car. In September, buyers of new cars paid $3,875,000 for this HUDSON Six-40 alone.

This averages $930,000 weekly. That is they are buying as fast as we build—100 cars daily.

No Other Class Car So Appealing

This is the largest sale of the season of a class car. Or by any car priced above $1200.

And it comes at a time when men are buying more carefully—comparing more closely—demanding more refinements than ever before. It comes at the climax of men's rebellion against over-tax and excess.

At this time—with all the new-year models out—men are buying five times as many HUDSONS as they bought one year ago.

Hudsons Now at Top

HUDSON models—designed by Howard E. Coffin—have been climbing up fast in late years. The HUDSON Six of two years ago was the largest-selling Six in the world.

But this new Six-40 has developed an avalanche of favor. In a single year it has quintupled HUDSON popularity. It has made the HUDSON—all things considered—the top-place car of today.

Note this one-year record. The first-model Six-40 came out a year ago. It outsold our output by 3000 cars. This 1915 model came out in July. We trebled our output to meet the demand for it. But on August 1 it was 4000 cars oversold. Now—with an output five times last year's—we are barely filling orders.

This is the Car Men Wanted

Four years ago, Howard E. Coffin—the great HUDSON designer—conceived this new-type car. He saw the trend of motorists' wants, and he started then to meet them. Since then—for four years—he has worked on this car. And the whole HUDSON corps of 47 engineers has worked with him.

He saw the end of awkward over-size. Here is a modest-size car with seats for seven and ample room for seven.

He saw the end of excess weight, due to wrong materials and crude designing. He has saved you here about 1000 pounds—the weight of a car-full of people.

He saw the demand for economy. With a new-type motor he has reduced operative cost about 30 per cent in this car.

He saw how beauty, comfort and convenience appealed to motor buyers. He has given you here—in all these ways—many unique attractions. Every detail—every part—has been refined in four years to the limit.

And he saw the demand for lower-priced quality cars. And here he gives you—through HUDSON efficiency—the lowest-priced class car built.

The Finished Ideal—Go See It Now

Today—at every HUDSON showroom—is the finished model of this new-day car. You will see every perfection—every refinement—which 48 men in four years have worked out.

And now all 1915 rivals are out to compare with it. This is the time to select your new car.

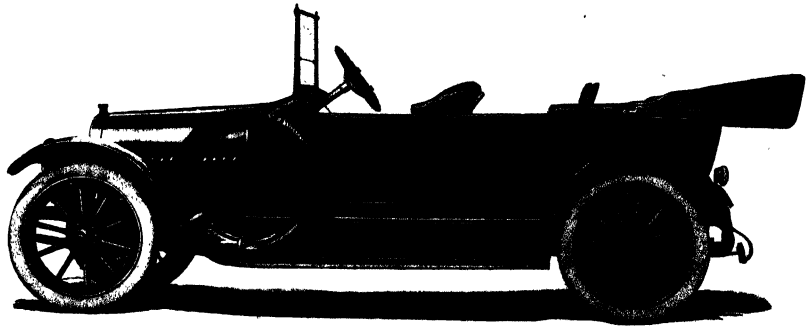
If you want an open body, there are months of fine driving ahead of you—the finest of the year. If you want a closed body, promptness will insure that you get it.

Go this week and see this HUDSON Six-40. If you prefer one at once, and your dealer can't deliver, we will ship one by express. Hudson dealers are everywhere.

Five New-Style Bodies

Seven-passenger Phaeton, $1,550; 3-passenger Roadster, $1,550; 3-passenger Cabriolet, $1,750; 4-Passenger Coupe, $2,150; new Town Car, $2,550. All f. o. b. Detroit. Canadian Price: Phaeton or Roadster, $2,100 f. o. b. Detroit, Duty Paid.

HUDSON MOTOR CAR COMPANY, 8338 Jefferson Ave., DETROIT, MICH.



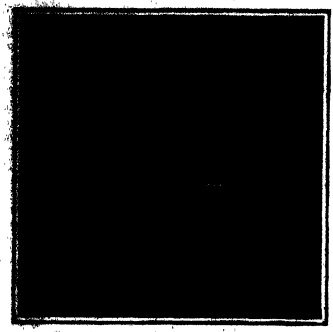
SEVENTIETH YEAR

SCIENTIFIC AMERICAN

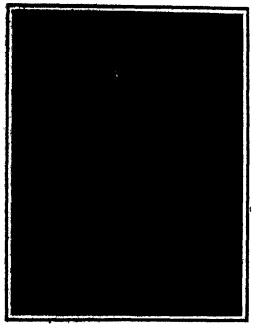
THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

NEW YORK, OCTOBER 10, 1914

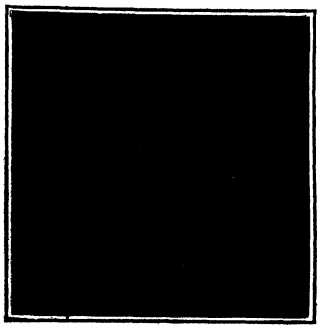
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Portable, collapsible cote for military use.



Carrier pigeon equipped with a two-lens camera.



Magnified picture taken by a carrier pigeon.

The Military Carrier Pigeon Photographer

The Homing Pigeon in the Army

MILITARY photographic "bird's eye views" have hitherto been obtained by means of balloons, kites, or rockets. Dr. Neubronner has discovered that they may be taken also with the aid of carrier pigeons.

It is not easy to construct an automatic camera with a maximum focal length of 2 inches and a maximum weight of 2½ ounces, including all appurtenances, but the problem was finally solved by a Frankfort firm. One form of the apparatus comprises two complete cameras, with their lenses directed forward and backward, so that at least one land view is obtained when both plates are exposed simultaneously in any position of the bird. The cameras are mounted on a thin aluminium cuirass which is attached to the bird by straps and rubber bands.

The shutter is released by a spoon-shaped lever. The bowl of the spoon is pressed outward by a hollow rubber ball filled with compressed air and perforated by a very small orifice. As the air slowly escapes, the ball collapses and the lever moves until it releases the shutter and makes the exposures at a moment that can be pretty accurately determined in advance. The pictures are 1¼ inches square. Another form of the apparatus contains a single lens and a strip of film on which eight pictures are taken at definite intervals with the aid of the air ball and clockwork. The number of pictures may probably be increased to twenty-four or thirty.

The carrier-pigeon photographer can render valuable service in many fields, and especially in the field of war, for obtaining information of the country and the position and strength of the enemy. The Prussian Minister of War has shown interest in the project and has put at Dr. Neubronner's disposal birds from the military pigeon station at Spandau, with which successful experiments have been made. The carrier pigeon flies at a height of between 150 and 300 feet, safe from small shot and very difficult to hit with bullets. Pigeons can be released from airships at any height within the enemy's lines, and they would carry home with them pictures of great value. The carrier pigeon is peculiarly well suited to service of this character because, when set free in a strange place, it commences its flight by describing a spiral curve, in the course of which several pictures could be taken from various points of view. Then, when the pigeon has determined the position of its goal, it flies thither in a straight line at a uniform speed of about 40 miles per hour. As the moment of exposure can be regulated with a fair degree of precision, the object which it is desired to photograph can generally be caught. In besieged fortresses information concerning the besiegers can be obtained by tumbler pigeons which, when released at their homes, fly in circles for a time and then return to their cotes.

In field service it will be necessary to provide portable cotes for the carrier pigeons. A pigeon can see and recognize its cote at a distance of more than twenty miles. Dr. Neubronner has devised a wagon carrying a developing room and a cote which can be raised on "lazy tongs" in order to release the pigeons at a good height.

War Will Not Halt the Panama-Pacific International Exposition

EARLY in August, in response to numerous inquiries, the management of the Panama-Pacific International Exposition announced that the exposition would not be postponed, but at that time no word had been received from any European nation as to what effect the European war would have upon its plans. In the last six weeks, however, it has become evident that many European nations will be represented at San Francisco.

Of the forty foreign governments which have committed themselves to participate, not one has withdrawn. Holland has increased its appropriation from $100,000 to $400,000 and ordered that construction be rushed upon the great Netherlands pavilion, and Spain, which had not decided to participate officially before the war, has since voted an initial fund, $100,000, for participation.

England, Germany, and Austria will be represented by individual exhibitors or by associations of exhibitors, and France has cabled that her plans are unchanged. Norway is proceeding actively with her plans, and Denmark broke ground for her pavilion the first week in September. The Argentine Republic, in view of the new trade alignments between the American continents, has increased its appropriation from $1,250,000 to $1,750,000; Italy has ordered construction rushed upon her great pavilion.

The Grand Duchy of Luxemburg, despite the war, has prepared and shipped a marvelous exhibit of unnamed roses to compete for the $1,000 prize for the Panama-Pacific International Exposition Rose.

Since the war broke out there has been a very sharp increase in the demand for exhibit space from the manufacturers of the United States, South America and the European nations not at war; and while there is now no doubt that many European nations will be represented at the exposition, it is apparent that in addition, there will be an unprecedented representation from South America and the Orient, as well as from Central America.



A 2½-ounce apparatus for taking eight pictures.

Color-Blindness

DURING recent years the subject of color-blindness has received much attention, especially in relation to men working on railways and on ships. Engine-drivers and ships' officers are now subject to examinations as regards their sight, both in respect to its strength and also to the power of discriminating between different colored lights. Many tests have been devised by means of wools and colored counters by which the sight of such people can be tested. It has now been found that color-blindness is always inherited, and that a man whose ancestry is free from it never exhibits it. Curiously, as was explained by Prof. William Bateson, in his presidential address, delivered before the British Association at Sydney on August 21st, color blindness is always inherited through the mother, and never through the father. There appears to be no instance in which a color-blind father has transmitted his defect to his children except in connection with a mother who was a transmitter. It does not follow, however, that the mother herself need be color-blind, but she must have inherited the power of transmitting this defect from the ancestor. Some, probably all, the daughters of a color-blind father inherit the power of transmitting the defect, although they themselves may not be color-blind, and, as a rule, they transmit it to about one half of their offspring of both sexes. The sons who inherit color-blindness are, of course, color-blind, but they do not themselves transmit it; it is the inheriting daughters who become the transmitters to the next generation. These facts ought to be of considerable assistance in the future to those who are responsible for investigating the eyesight of engine-drivers and officers of ships, provided that they are able to carry their investigations back through at least a couple of generations in the family. If it can be shown that two generations are free from color-blindness there is at least very good reason for supposing that the third generation will also be free.—*Engineering.*

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

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The Battleship Versus the Submarine

NOT many months before the start of the present war, Admiral Sir Percy Scott stated his conviction that the submarine was already so far the master of the battleship, that it was unlikely that many more of the latter would be built

A month before the breaking out of the present conflict, one of the most capable and farsighted of the officers of our navy, in discussing Sir Percy's statement with the writer, said that in the event of a naval war between two great powers, such, for instance, as Great Britain and Germany, it was quite possible that the battleship fleets of both navies would not dare to cruise on the high seas, in the proximity of the enemy's bases, until the submarine fleets of one or other of the contestants had been practically destroyed.

To many students of the war, it will appear that the sinking by a single submarine (if the German statement is correct) of three large armored British cruisers in less than one hour, is strong confirmation of the views of these two officers of the British and United States navies.

Already, as the result of this brilliant exploit, it is being freely stated that at any time we may learn that several of the British battleships have met a similar fate. This view is based upon the belief that the battleship fleet of Great Britain is engaged in a close blockade of the German coast, and is cruising to and fro a few miles off Wilhelmshaven, Helgoland, and the entrance to the Baltic. If this were the case, the peril of the submarine would be great indeed.

As a matter of fact, the battleship fleet, it may be safely said, is not within a hundred miles of the German coast. We hazard the statement that it is gathered at some mine protected base, a roadstead or harbor on the English or Scottish coast, and the blockade of the German coast is being maintained by a fleet of cruisers, scouts, and destroyers, each squadron of which is patrolling its own assigned stretch of water and keeping in touch by wireless with the distant battleship fleet

It is the principal duty of these ships of lesser value to keep close watch and detect the first signs of the German battleships passing out into the North Sea. In that case, Admiral Jellicoe would maneuver to gain contact with the enemy and bring on a general engagement. In fact the only motive of Admiral Tirpitz himself in venturing into the North Sea would be to fight a line of battle engagement

The absence of any coaling base would render it impossible for the German fleet to make any extended raid upon the English and French coasts, and a general engagement against such overwhelming odds as sixteen battleships against thirty or more would spell disaster

It will be remembered that Admiral Togo waited for the Russian fleet behind one of the islands of the sea of Japan, and threw forward a screen of scouts, to get in early touch with the Russians. It is practically certain that the British battleships are far removed from the field of probable submarine attack, and that, like the German battleships, they are so located that they can be protected by a complete cordon of mine fields, torpedo booms, nets, and heavy interlaced cables.

The blockading fleets of lighter and less valuable vessels must necessarily cruise within observing distance of the coast, and these vessels are, and throughout the whole war will be, exposed to submarine attack. There is no doubt that the submarine flotillas of the Germans have been actively engaged in hunting for these ships ever since they appeared in the offing. The best protection for the cruisers and destroyers is to steam at not less than fifteen knots, and to make constant changes of course and cruising ground. Such a submarine as the "U-9," which sank the armored cruisers, can make only eight knots, when submerged; and at that low speed it is difficult to close in on a ship moving at fifteen knots or more. The ships that were sunk were making only seven knots, a fatally low speed, as the event proved, in waters infested by submarines.

The Germans will be greatly emboldened and the British rendered more cautious by the recent disaster; but in spite of all watchfulness, it is certain that now and then we shall hear of other blockade and patrol ships being intercepted and sunk by this comparatively new and justly dreaded form of attack.

The Seven Wonders of the Modern World

THE contest which the SCIENTIFIC AMERICAN conducted about a year ago with the object of ascertaining what are the ten greatest inventions of our time—inventions, in other words, which have been commercially introduced within the last twenty-five years, seems to have inspired the European press with the idea of conducting similar inquiries. The *Berliner Lokalanzeiger* recently asked its readers "What are the seven wonders of the modern world?" thereby bringing down upon itself a veritable avalanche of replies. No less than 151,764 readers of the paper were heard from, each having promptly reacted with seven answers.

The result of the contest is illuminating, not because it definitely establishes what are the seven wonders of the modern world, but how great is the power of publicity, how responsive is the general public to the influence of the press. For example, 17,148 votes were cast for wireless telegraphy, 16,250 for the Panama Canal; 12,828 for the flying machine; 11,428 for applications of radium; 11,296 for the moving picture machine; and 6,276 for the steamship "Imperator." All of these have received much publicity. Wireless telegraphy is placed in the first rank by less than one eighth of all the votes. Apparently 134,616 contestants either never heard of Marconi and his achievements, or did not consider wireless of much importance.

In commenting upon the psychological aspects of this contest, a writer in *Prometheus*, the well-known German scientific periodical, points out that the voters were not able to bring forward the necessary proof that a single one of their selections is a world wonder in the accepted sense. It would not have been too much to ask that all the 151,764 voters should have agreed upon at least one modern wonder. If there is one supreme modern achievement, surely all would have noted it.

Even assuming that seven modern wonders were to be enumerated, and that accordingly there is more than one really great wonder, it may be further assumed that 151,764 votes would be cast for at least two or three achievements. But even wireless telegraphy, which received the most votes, was not elected to its position with the usual majority of votes; only one eighth of all the votes were cast for wireless.

The writer in *Prometheus* examined the psychological side of this contest by classifying the wonders according to their nature. He finds that they fall into three classes:

a. Scientific discoveries, such as wireless telegraphy and the application of radium.

b. Pure inventions such as the dirigible balloon, the flying machine, and the moving picture machine.

c. Remarkable structures, such as the Panama Canal and the steamship "Imperator."

How do the 151,764 voters estimate the relative merits of these wonders in their particular classes?

The selection of wireless telegraphy by 17,148 people must be at once commended on this basis, despite the paucity of votes. On the other hand, the Panama Canal has received almost as many votes. Conceding that the Panama Canal is really a noteworthy achievement, still it must be admitted that the success of the achievement depended in large measure upon unlimited financial resources. The same applies to the "Imperator." Moreover, the "Imperator" has been exceeded in size by the "Vaterland," and the "Vaterland" will probably be exceeded in the future by still other vessels. Admitting that the Panama Canal and a giant ship are wonderful in their way, they are not world wonders in the true sense of the term. Hence their selection must be attributed to the great publicity which they have received and therefore to a kind of mob suggestion.

What remains? Radio-active investigations in the

[illegible] and the moving picture [illegible] ordinary. This would seem [illegible] is able to offer every [illegible] form of human activity. [illegible] publicity given to great inv[illegible] play in daily life, is to be ex[illegible] few people in the world have [illegible] knowledge of scientific probl[illegible] average person know of th[illegible] scope, astronomy, spectroscop[illegible] physics, or for that matter, [illegible] the work of an investigator like [illegible] investigations of a Wassermann [illegible] to be mentioned with the great work [illegible] If we are to regard the Panama Canal as a wonder, simply because it is [illegible] with the same fervor of the [illegible] great suspension bridges that [illegible] the Woolworth Building, and st[illegible]

The contest did not reveal wh[illegible] ders of the modern world, but it [illegible] persons could not agree upon a [illegible] ment which deserved to outrank all [illegible]

Scientific Men and Con[illegible]

AT the conclusion of the war [illegible] Europe the world at large [illegible] adopt one of two alternates. [illegible] be a great general movement in the [illegible] armament and permanent peace, or ther[illegible] among all nations an increased prepared[illegible] Of these two alternatives the first is the m[illegible] The stupid and avoidable waste of life a[illegible] the disorganization of the world's commerc[illegible] set-back given to civilization will awaken [illegible] ing disgust throughout the world. Efforts w[illegible] to secure a world-peace.

But supposing that through lack of inte[illegible] or collective will these efforts prove abortive, we [illegible] with the other alternative. One consequence of this will be that England and America, in common with other countries, will sooner or later be led to adopt conscription, and it is one aspect of this that we propose to discuss. We wish to point out that certain small sections of the community should be exempt from conscription, and that for several reasons scientific men and artists of proved ability should not be required to fight. They could, of course, volunteer, but they should not be compelled.

Scientific men and artists are essentially cosmopolitan creatures. Their work is in no sense local: they do not benefit any one nation in particular, but the world at large; and so far as the ultimate good of the human race is concerned they are undoubtedly the most valuable class in the community. They are of incalculable value to the world in all that pertains to the advancement of mankind. They are the trustees of the future. Regarded in this way they count enormously, but there is no reason to suppose that as warriors they would be more efficient than any other class. The probability is that with their generally rather poor physique and lack of practical intelligence, they would be less efficient as fighters than the average man. Their numbers are small and their fighting abilities slight.

Surely one of the most appalling things about the present war is the fact that some of the most brilliant young men in Europe, men who cannot be replaced, have been ruthlessly butchered. These men belong to the wider issues. Science is more important than the preservation of any one country's independence. An effective remedy for cancer is worth a colony. It is merely a question of economics. As a matter of probability, the loss of these lives entails an inconceivably greater loss than any gain their presence in the fighting line is likely to bestow.

The "California" Class of Battleships

ALTHOUGH the three battleships of the "California" class, an illustration of which was given in our issue of September 26th, are practically identical with the "Pennsylvania" and "Arizonia," it has been decided to give them a separate class name. The "Pennsylvania" and "Arizona" will have the usual ram bow, which they were designed to carry. The "California" class, which will be known as the "California," the "Idaho," and the "Mississippi," will be distinguished from them by carrying the clipper bow shown in our illustration of the new ship.

It has been the broad policy of our navy to build our battleships in classes of five each, so that the active fleet in commission will consist of divisions of four ships in active service with the fleet, the fifth ship being at the navy yard for its annual overhauling. The "California" and the "Pennsylvania" will be practically identical in size, speed, armor protection, and armament, and, therefore, they will form a group having the same speed and general maneuvering qualities. Although, when they are all completed, they will be alike in all military particulars, it will be easy to distinguish the two classes by the shape of the bow.

Electricity

Electrical Instrument Supplies.—A call for [illegible] has come from Buenos Ayres, Argentina, as the war the stock of electrical goods has [illegible] diminished, and there is an immediate demand for new supplies. The call comes from a representative of the Chicago Association of Commerce which [illegible] exhibition of articles, manufactured by its members, at Buenos Ayres.

Varnish Cloth and Electric Wiring.—A correspondent has sent us a clipping from a local paper describing a curious [illegible] resulted from whitewashing a barn. The [illegible] contained a strong percentage of salt, which caused it to dry very slowly. The salt crept through the lining of the electric light lines and also those of the [illegible] company, forming a short circuit which burned [illegible] places in the ceiling when the lights were turned [illegible] salt formed a conductor that extended to practically every piece of metal in the barn, as is shown by the fact that light shocks could be obtained by touching [illegible]

Storm Detector for a Central Station.—The weather has a great deal to do with the demand for electric light. Hence it is necessary for an electric service company to keep an eye on approaching storms, so that preparations may be made for a coming spell of darkness. Recently, a company in New York has installed a storm detector similar to wireless telegraph receiving apparatus which is affected by neighboring thunderstorms and announces their presence by ringing a bell. The nearer the storm the more frequently does the bell ring, and within an hour to a half hour before the storm breaks, the bell rings continuously. Thus there is ample warning to prepare additional generators for service when abnormal demands for current are felt.

Tungsten Lamps vs. Gas Mantles During the War.—The keen competition, in some localities, between gas and electric lamps is liable to be affected materially by the present European war. Thorium, which is an essential constituent of the gas mantle, comes chiefly from Germany. Now that this source of supply has been cut off, manufacturers of gas mantles will be seriously crippled as soon as their present stocks of this rare earth are exhausted, unless the war comes to an end before that time. Manufacturers of electric lamps will no doubt make use of the opportunity to replace the gas mantles with tungsten lamps. The critical condition of gas mantle manufacture is indicated by the fact that efforts are now being made to save the ash from broken and burned-out mantles, so that the manufacturers may reclaim the thorium contained therein.

Electricity in Coal Mines.—In a paper read before the British Association in Australia, Dr. W. M. Thornton gave a summary of his investigations of electricity in coal mining. He studied particularly the limit of electrical ignition of mine gases and coal dust, and found that electric bells are apt to produce sparks at the trembler or at the push button, of sufficient intensity to ignite the gases. He arrived at the conclusion that all electric lamps, fuses, etc., no matter what their size, should be enclosed. However, all sparks are not of sufficient intensity to ignite the gas. For instance, the blue brush discharge from high pressure conductors will not light the gas, nor was he able to produce ignition with static discharges from a high speed belt. He also arrived at the conclusion that nothing was to be feared underground from wireless telegraph operation on the surface, as no dangerous sparks are induced therefrom.

Electrolytically-Produced Luminosity.—In a paper, recently read before the Royal Society, says the London *Electrician*, Mr. L. H. Walter took up the conditions under which it should be possible to make practical use of the luminosity of anodes of alloyed aluminium forming part of a "valve" cell arrangement. The alloy known as "duralumin" is found to give the best results, and, with sodium tungstate solution as electrolyte, corrosion is practically eliminated when this alloy is used as the anode. The difficulties with immersed anodes led the author to employ anodes which are completely dry, except as regards the front surface, which is kept wetted by means of a layer of electrolyte caused to flow down it in a continuous stream, the flow being distributed by using a transparent crêpe screen which clings to the anode surface. In this way, the anode being dry at the back, electrical connection can be directly established there, without the great care as to insulation otherwise needed. This arrangement permits of the construction of an apparatus having a multiple anode, comprising a vast number of equal units in quite a small compass, each such unit being capable of being rendered luminous in any order in sequence desired and at a speed of some hundreds of times per second. In the author's experimental apparatus there are over 5,000 such separate units in a space the size of a cabinet photograph—a number which it would hardly be possible to obtain by other means. Such an apparatus is capable of being employed as a receiver for photo-telegraphy for the reproduction of pictures, etc., especially where these are received as [illegible] impulses.

Science

A New Comet Discovered.—Word has been received that a new comet visible to the naked eye was discovered by Prof. Clarence T. Haggerty, of the New Mexico College of Agriculture and Mechanical Art, East Las Cruces, New Mexico, on September 25th. The comet was located in R. A. 0. hour 5 minutes and Declination —45 deg. at 11.30 P. M. on the date of discovery.

Flowering Plants Above Snow-Line.—Investigations by Herr von Klebelsberg in the Tyrolese Alps have revealed the existence in that region of no less than 86 species of flowering plants above the snow limit, and of these 56 were found some 300 feet above the snow-line, while six occurred over 1,500 feet above. The highest species of all, the glacial Ranunculus, was met with at over 12,000 feet above sea-level on the Grossglockner. In another part of the Alps, viz., on the Finsteraarhorn, it has been found at nearly 13,900, the greatest height attained by a vascular plant in the Alps.

Smoky Air and Animals.—Whether live-stock is likely to suffer when living in the neighborhood of railroad yards, industrial plants and large manufacturing centers, was the question that the Leeds University proposed to Yorkshire farmers, and the answers showed the affirmative not only for animals but also as concerns grass and other plants. It appears that the growth of young stock is kept back under such conditions, and in the case of old stock or horses these are seen to require much more care and food than those which live in a pure air. Such effects on animals are due partly to the direct action of the vitiated air when taken into the lungs and on the other hand by the very poor quality of the grass that grows here, as it cannot develop under good conditions. Sheep raising is found to be specially difficult in these places, even impossible. Near Leeds, this had to be discontinued, for the wool was of very poor quality, besides being full of impurities of various kinds. Thus it appears that the same general rules apply to animals as to human beings under such circumstances.

Shackleton Starts for the Antarctic.—The European war has not prevented the Imperial Trans-Antarctic Expedition from embarking for the south, notwithstanding the fact that some of its members belong, as Shackleton himself formerly did, to the British Naval Reserve. When the reserves were mobilised at the end of July, Sir Ernest offered the services of the expedition, with its stores and provisions, to the Admiralty, but fortunately the offer was declined with thanks. The "Endurance," the ship of the Weddell Sea party, left the Thames August 1st and Plymouth August 8th, carrying part of the expedition to Buenos Aires. The "Aurora," which is to carry the Ross Sea section of the expedition, is now at Hobart, Tasmania, and will sail for the Antarctic about the beginning of December. Shackleton and the members of his staff who had not already sailed on the "Endurance" left England September 18th by mail steamers; half of the expedition sailing for Buenos Aires, and the other half for Tasmania. Their departure was delayed by the necessity of buying in England scientific instruments to replace those which had been ordered from Germany.

The Latest Disaster in the Arctic.—While a recent note in these columns concerning the Canadian Arctic Expedition was in the press, news was received that the survivors of the "Karluk" party had been rescued from Wrangel Island on September 7th, by the gasoline schooner "King and Wing," and transferred the next day to the revenue cutter "Bear," on which they reached Nome, Alaska, September 13th. Unfortunately, only a remnant of the party which went adrift on the "Karluk" last autumn has survived. Grave fears for part of the expedition which were aroused by Capt. Bartlett's narrative of last July have proved to be well founded It will be recalled that when Bartlett left Wrangel Island, on his hazardous trip across the sea ice to Siberia to seek aid for his comrades, eight of the latter had not yet reached the island from the scene of the shipwreck, though it was hoped that they would do so later. These were: A. Forbes Mackay, surgeon; James Murray, oceanographer, Henri Beuchat, anthropologist; A Anderson, first officer, Charles Barker, second officer; and seamen Brady, King and Morris. These eight men have never since been heard from. Mackay and Murray were both members of Shackleton's last antarctic expedition, and Murray was biologist of the Scottish Lake Survey, under the late Sir John Murray. Beuchat was a well-known French ethnologist. Further casualties to the expedition include the death from disease of George Malloch, chief geologist, and Bjarne Mamen, assistant geologist, and that of seaman Breddy from an accident. Malloch was attached to the Geological Survey of Canada, while Mamen was a Norwegian. The men rescued from Wrangel were. Wm. McKinlay, meteorologist and magnetician; John Munro, chief engineer; B. Williamson, second engineer; R. Templeton, steward; J. R. Hadley, carpenter and dog-driver; Maurer, Williams, and Chafe, of the crew; and an Eskimo, with his family.

Aeronautics

Stabilizer for Hydro-Aeronautical Apparatus.—Charles Denniston Burney, of Killmeston, Alresford, England, has secured patent, No. 1,107,260, in which he seeks to enhance the stability of hydro-aeronautical apparatus, particularly during certain stages of transition from the hydro-volant to aero-volant condition.

Heating the Gas Container from Exhaust.—In the patent, No. 1,108,770, to Daniel Lopez and Mike R. Lerma, of San Bernardino, Cal., hot air is utilized for keeping the machine suspended in the air, and the exhaust from the motors maintains the sustaining gas in a heated condition.

Automatic Balancing Features.—In the aeroplane, patent No. 1,107,494, John Q. Chase, of Dayton, Ohio, is provided a balancing feature so constructed that the movement of the machine from level or normal position will automatically bring the balancing features into action by which the machine will be returned to normal position.

Week-End Aviation Meets at Hempstead.—Under the auspices of the new Week-end Meet Association, there has been flying, Saturdays and Sundays, for the last three weeks, at the Hempstead Plains Aviation Field Races, bomb dropping and fancy flying have been indulged in. The meets will continue throughout October They offer an opportunity for those interested in aviation to see the latest machines performing at their best

The Aeronautical Society's Race Around New York.—Encouraged by the success of the race around New York city, which was held in conjunction with the Times last fall, the Aeronautical Society plans to hold another similar event on Columbus Day, October 12th. In all probability, even more machines will compete this year than the half dozen that successfully flew the 40-mile course in 1913.

A Glenn Curtiss Flying Machine Patent.—Mr. Curtiss, in a patent, No. 1,108,490, seeks to provide novel constructions by which to obviate the objectionable effects of side wings particularly those to which flying machines are often exposed when at rest and which tend to cause a lifting pressure beneath the lateral portions of the main supporting wings at the windward side of the machine and either turn the machine over or bring about undesirable strains.

The Sikorsky Machine in War.—We receive advices from abroad that the Sikorsky machine, recently described in the columns of the SCIENTIFIC AMERICAN, was used by the Russians in reconnaissance, at the very commencement of hostilities It is said to have been brought down by the German fire. This would not be difficult if the machine were flying reasonably low, because of its slow speed. It can hardly make more than forty to forty-five miles an hour.

Patents for Aeroplane Guns.—Cleland Davis, U. S. Navy, has secured three patents, Nos. 1,108,714–715 and 716, relating to the firing of projectiles from aeroplanes, patent No. 1,108,714 being for an aeroplane gun having special construction for operating in connection with the recoil, while patent No 1,108,715 is for an apparatus for firing projectiles from aeroplanes, and No 1,108,716 is for another apparatus for firing projectiles from aircraft. A patent, No 1,108,717, has issued to the same parties for fixed ammunition for use on aircraft.

A New Military Aeroplane.—A new type of military aeroplane, designed by Glenn H. Curtiss, has been tried out at San Diego, Cal., and developed remarkable speed and climbing ability The new machine has wings shaped like those used on the flying boat America, the under surfaces being almost flat while the upper faces are highly arched, with a wing spread of over forty feet The official requirements were that a weight of 600 pounds of useful load should be carried at a speed between 45 and 70 miles an hour, and climb at least 3,000 feet in ten minutes. It must also be able to rise from long grass or harrowed ground. In the trials all of these requirements were easily exceeded, although the engine was rated at only 90 horse-power, and a speed of 86 miles an hour is said to have been attained

Studying Atmospheric Perturbations in an Airship.—The pitching and rolling of a dirigible balloon afford interesting information regarding the waves, eddies, and other perturbations in the atmosphere The committee on dirigibles of the Aero Club de France has recently drawn up instructions for observing and recording these movements for the benefit of meteorology. The committee recommends that every airship be equipped with a "clino-barometer," i. e., a clinometer, for indicating the inclination of the vessel to the horizontal, combined with a barometer, for showing the elevation. Both instruments trace a continuous record on a moving sheet of paper. There are two additional pens; one to record the time by marking minutes, and the other, at the control of the aeronaut, for marking more definitely any particular instant at which some phenomenon has been noted. While such observations are in progress, the pilots are expected to refrain from using the stabilizing apparatus of the airship more than necessary.

Laying the Aqueduct Siphon Across the Narrows to Staten Island

New Method of Making Flexible Yet Water-tight Joints

THE last gap in the great 120-mile aqueduct that is to bring mountain spring water from the Catskills into New York is now being closed This is the 36-inch siphon running under the Narrows from Bay Ridge to Tompkinsville, Staten Island, and in many respects it is the most interesting work of the whole aqueduct system, for an entirely new method is being pursued.

The siphon is, roughly, 10,000 feet long, and must run directly across the main ship channel entering the harbor of New York, at a place where the tidal currents are swift and very difficult to contend with. In these busy and exposed waters, at the depth at which the aqueduct must be laid (about sixty feet below the mean sea level), it is impracticable to conduct diving operations Consequently, a plan was worked out by which the siphon could be laid without the aid of divers. Our frontispiece illustrates the method that is being employed The pipes are being connected above water with flexible joints, so that they may run down a launching cradle or skidway, and the joints are of such a character that no caulking will be required after the siphon has been laid.

At first thought this might lead to some apprehension on the part of the public lest the joints might not be absolutely tight and the drinking water be contaminated by leakage. It may add to their consternation, particularly of those who dwell in Staten Island, to know that the siphon leaves the Bay Ridge shore right beside the outlet of a large sewer. But a moment's reflection reminds us that the water flowing through the siphon must rise to Silver Lake in Staten Island, which lies at a height of 225 feet above sea level. Hence, the water must have a head of at least 225 feet, or 97 pounds per inch more than the surrounding water, at every point along the siphon. Obviously the danger is not that water may leak into the pipe line, but that it might leak out, and with a line 10,000 feet long the leakage might amount, in the total, to a very considerable loss. Hence, the pipe joints have received most careful attention, to make them absolutely tight and yet flexible enough to slide down the skidway and adjust themselves to the more or less uneven bottom. Flexible pipe lines have been laid before without experiencing difficulty with the joints after they had been rendered tight, owing to the fact that the line in sinking into the mud puts a tension on the joints; it is an easy matter to preserve water-tightness as long as the joints are under tension. But in this case, with a line 10,000 feet long, far longer than any other submarine line we know of, it cannot be assumed that all the joints will be constantly under tension. In fact, it is safe to assume that many of them will not be under tension, and one of the main difficulties encountered in designing the form of the joint was to provide for flexibility and yet water-tightness under all the conditions the line will be subjected to when it assumes its final position in the bed of the Narrows

The pipe sections are 12 feet long, with an internal diameter of 36 inches. Each section is formed with a spigot at one end and a bell at the other, the space between the spigot and bell being filled with lead, so as to form a ball and socket joint Fig. 1 shows a section of the wall of the pipe at the joint. The bell is turned and ground to a sphere in which a variation from perfect sphericity of only 0.006 inch is allowed. The end of the spigot is formed with a collar turned to fit the bell accurately, while the outer surface of the spigot is formed with shoulders or annular ridges between which are recesses, in which the lead that fills the joints will be retained. It takes about 330 pounds of lead to fill the space between the bell and spigot. But, on cooling, this, of course, shrinks. It has been customary heretofore to close such joints by calking after the pipe is laid, but as divers could not very well be used on this siphon, a method was sought which would insure a perfectly tight lead joint before the pipe was lowered into the water. As a result of a workman's suggestion, it was decided to introduce slugs or "pellets" of cold lead into the lead filling after it had hardened, and by forcing in the cold lead to expand the lead filling until it came into intimate contact with the surface of the bell. Threaded holes were formed in the bell, through which the lead pellets were introduced and forced in by means of gib screws. A great deal of difficulty was experienced first, owing to the tendency of the spigot to move out of the bell slightly when the lead was introduced. But after much experimentation, which consisted chiefly in varying the location of the annular ridges on the spigot and the holes through which the lead slugs were introduced, the difficulty was overcome. The form of spigot finally adopted is that shown in Fig. 1.

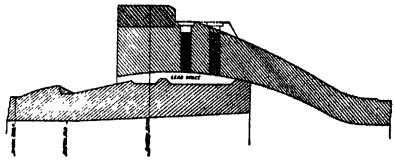


Fig. 1.—Longitudinal section, showing the construction of the flexible joint.

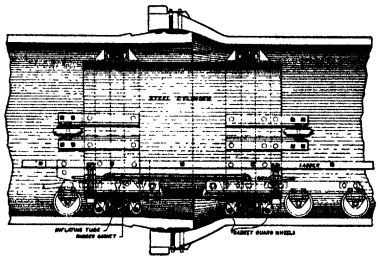


Fig. 2.—Apparatus for testing the joints of the siphon.

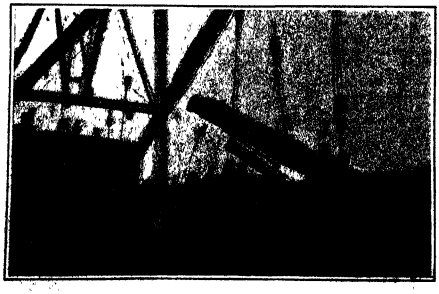
There are thirty-two holes in each bell, arranged in two staggered rows. The joint is cast in the launching cradle. After the lead has been poured in [illegible] mounted on the pipe, and this carries [illegible] tools with which the gib screws that [illegible] the bell are unscrewed and removed. There [illegible] ests at four points equally disposed about [illegible] of the bell. After the gib screws have [illegible] the lead pellets, which measure 9/16 of an [illegible] diameter by 1¾ inches long, are introduced into the hole, and then the gib screws are screwed [illegible] force the pellets into the cast lead. [illegible] takes about twenty-two pounds of cold lead to [illegible] shrinkage space. Three pellets [illegible] into each of the upper holes [illegible] the lower ones, and the gib screws [illegible] far enough into the cast lead to [illegible] pression into which a mixture [illegible] and grease is introduced. Then [illegible] screws are replaced by permanent [illegible] which force the lubricant into the joint. [illegible] done, the pipe section is oscillated, to [illegible] that the joint is flexible, and thereafter [illegible] subjected to a hydraulic test to determine [illegible] tightness.

The hydraulic testing apparatus is shown in Fig. 2. It consists of a cylinder mounted on wheels, which is lowered into the pipe until it comes to the joint. Surrounding each end of the cylinder is a dam, consisting of a rubber hose similar to an automobile tire, which bears against a rubber gasket. When water is introduced into the hose it is inflated, forcing the gasket tightly against the inner wall of the pipe. At the same time water is introduced into the space between the cylinder and the pipe and raised to a pressure of 100 pounds to the square inch. This pressure is retained for a period of ten minutes, while the joint is watched to see whether any leakage occurs. Originally it was proposed to use a pressure of 200 pounds per square inch, but it was found that this would not give a fair test, for it actually resulted in tightening the joint by producing a longitudinal movement of the spigot with respect to the bell. With the lower pressure there is practically no such movement.

As shown in our illustration, the skidway consists of a bridge truss, the panels of which are connected one to the other at an angle of 5 degrees, so as to produce a curved launching way. This passes down under the pipe-laying lighter with its lower end dragging in the trench in which the pipe is to be laid. As the skidway is very heavy, a buoyancy cylinder has been secured to the after end, to prevent it from sinking deeply into the mud of the harbor bottom. This cylinder, although not shown in our front page illustration, may be seen in one of the photographs.

It will be realized that it is very necessary to keep the lighter in true alinement with the trench. For this reason ten anchors are used on cables from a thousand to twelve hundred feet long, there being two forward, two aft, and three at each side. The cables lead to a system of power-operated drums. When a joint has been completed and tested, the lighter is moved forward by taking in on the forward cable and letting out on the after ones, until the bell on the section just connected is lowered to a convenient position to receive

(Concluded on page 310)



Lowering the first three sections of the siphon into the launching cradle.



Lowering the launching cradle. Note the buoyancy cylinder.

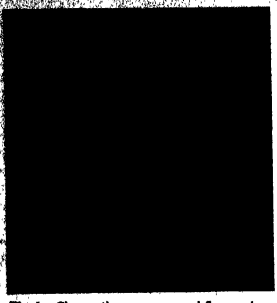


Fig. 1.—Chrysanthemum, a normal flower, shows black in ultra-violet light.

Flowers Photographed With Invisible Light

High Reflecting Power for Ultra-violet Rays of Certain Yellow Blossoms

By G. Michaud and F. Tristan, Costa Rica State College

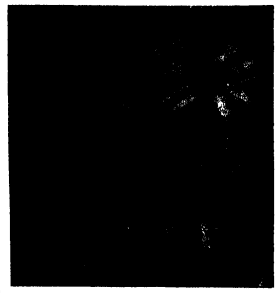


Fig. 2.—Same as Fig. 1, but in visible light. The chrysanthemum shows white.

PROF. WOOD was first to note that some white flowers appeared with black petals on photographs made in ultra-violet light of some 3,200 Angstrom units. On a photograph of honeysuckle, white phlox, and geranium, published in the November 15th, 1913, issue of the SCIENTIFIC AMERICAN, Prof. Wood observed that while the petals of both phlox and honeysuckle came out dead black those of geranium were lighter in tone. The writers have repeated and extended those researches to a total of ninety-seven flowers representing the most important families and many shades of red, yellow, blue and violet, besides pure white. They came to the conclusion that, with the exception of the few yellow flowers which will be described further under the name of ultra-violet flowers, differences in the absorption of ultra-violet light by petals are small when compared with the almost general high absorbing power of corollas of all color for these radiations. Flower after flower, whether white or colored, left a black or dark gray image on the photograph made through Foucault's silver film, while, in visible light, they came out, as could be expected, in widely different shades. For some time the writers were even led to believe that a strong absorption of ultra-violet light was quite a general law among corollas, until it happened that one yellow flower, *Cucurbita Pepo*, the common squash flower, came out on the positive with a pure white tint. Such was the contrast with all previous photographs of other flowers that it was for a moment considered as the result of an involuntary substitution of the ordinary objective to the silvered quartz lens. Further work brought out similar flowers, all of them yellow, the list of which follows: *Cucurbita Pepo, Leontodon Taraxacum* (Dandelion), *Cassia Pubescens; Tithonia Speciosa; Cucumis Sativus; Sonchus Oleraceus; Spilanthes Parvifolia; Sida Rombifolia, Oenotera Sp; Oxalis.*

For these abnormal corollas the writers propose the name of "ultra-violet flowers," which recalls their high reflecting power for ultra-violet light as contrasted with the high absorbing power of all other flowers, whether colored or white, in similar circumstances. All ultra-violet *corollas, so far,* are yellow, but most yellow flowers are not ultra-violet and come out, on photographs made in ultra-violet light, as normal flowers do, that

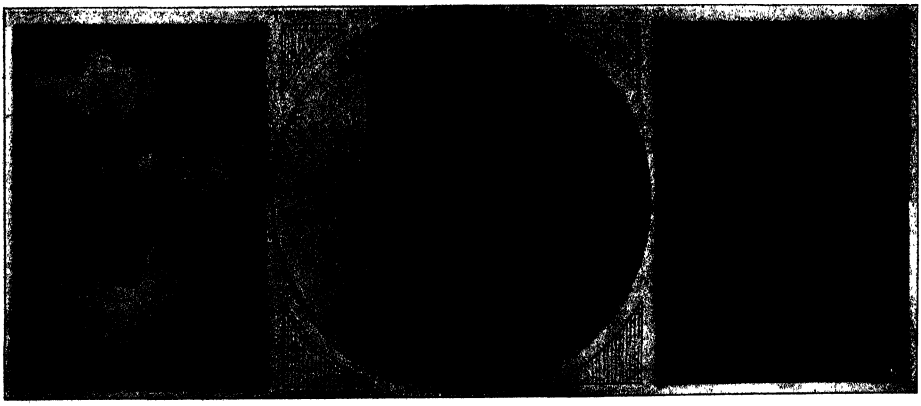


Fig. 3.—Common squash, an ultra-violet flower, shows white in ultra-violet light, but (Fig. 5) dark in visible light. Fig. 4.—Handy method of detecting ultra-violet flowers.

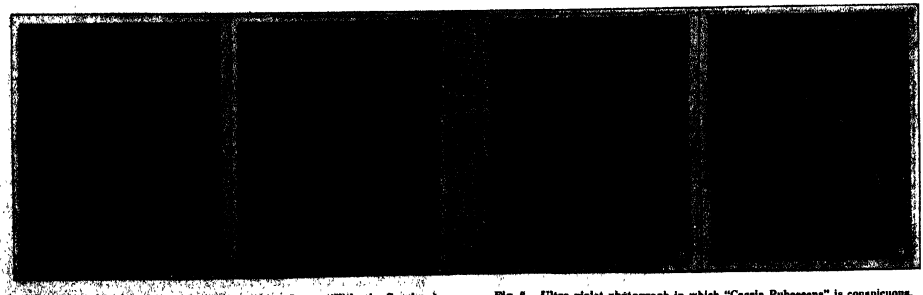


Fig. 6.—Three specimens of an ultra-violet flower (Tithonia Speciosa) among normal flowers. Fig. 7.—Same, photographed by visible light.

Fig. 8.—Ultra-violet photograph in which "Cassia Pubescens" is conspicuous. Fig. 9.—Same, photographed by visible light.

is, as dark patches. Nothing in the visible color or appearance of yellow flowers allows of any distinction between the yellow-ultra-violet and the yellow-black flowers. In both classes several shades of yellow, from the orange to a greenish yellow, are found.

The strong absorption of ultra-violet light by most corollas perhaps affords protection to the ovary and stamens. Such a protection is given to our own tissues by the pigment contained in the skin, and where pigment is scarce sunstrokes are likely to occur. Ultra-violet light rapidly destroys many unprotected organisms such as microbes, and Guilleminot has shown that short wave length radiations are particularly harmful to ovules. If it be considered that most corollas not only reflect, but moreover concentrate light upon the ovary and stamens the necessity of a sifting of the radiations and of the elimination of short wave lengths becomes most evident.

As to the abnormal ultra-violet corollas, it is interesting to note that among those of the *composite* family, only the exterior corollas, so far, are ultra-violet. The interior flowers come out black on the ultra-violet photographs, although they may be apparently just of the same yellow color as the outside peripheric corollas. In ultra-violet flowers of other families, light is reflected under such an incidence as to make it probable that its destination is the outside rather than the inside of the flower. From such facts it may be inferred that the function of the ultra-violet light reflected by the abnormal corollas is perhaps the same as that of visible colors, i. e., to attract those insects which play an important part in fertilization. The fact that our own retina does not perceive ultra-violet light is no good proof against that hypothesis. All retinas are not made upon the same plan nor are probably adapted to one and the same scale of wave lengths.

While photography is, so far, the surest guide in the detection of ultra-violet flowers, the writers found recently that another method can be successfully used for the same purpose. Owing to the great difference in the reflective power of normal and ultra-violet corollas for ultra-violet light, an ultra-violet flower, placed in the path of a beam of ultra-violet light, in such a position as to reflect most of the invisible light upon a sheet of white paper moistened with a solution of acid quinine sulphate, causes this alkaloid to become highly luminous, while nothing is observed with a normal flower, whether white or colored, in the same circumstances. When the experiment is made as shown in the accompanying figure it is always very successful. In a dark room, a circular hole is made in the shutter. With the help of a pasteboard tube, a Zeiss Uviol filter *U* (Uviol glass cell containing a copper sulphate solution) is placed in the path of a beam of light coming from the blue sky. *Q* shows the position of the white paper which has been previously moistened with a solution of quinine sulphate to which a few drops of sulphuric acid have been added; *F* that of the flower. The selection of the most favorable incidence for the flower is made easy if the experimenter takes the trouble of waiting from 15 to 20 minutes in the darkness before beginning work. Owing to the powerful adaptation of the retina for small wave length radiations, part of the ultra-violet light becomes then visible and the Zeiss filter is perceived as a violet disk.

A study of the vertical distribution of ultra-violet flowers might reveal interesting facts, as sunlight at great altitudes not only is richer in ultra-violet radiations, but contains moreover wave lengths which are not found at sea level.

These curious phenomena led us to seek what becomes of the selective reflection of flowers in the opposite end of the spectrum, that is among the great infra-red wave lengths. For that purpose we resorted again to the photographic method and used one of the filters proposed by Prof. Wood and made by Messrs. Wratten and Wainwright of Croydon, England (a yellow film cemented between two dark cobalt glass plates). The first radiations admitted by that filter are found in the neighborhood of 7,400 A. U. On the other hand, the last radiations which affect a plate sensitized with alisarin blue *S*, ammonia and silver nitrate, stand at about 9,500 A. U. Hence it may be stated that the accompanying photos of corollas were made exclusively by those extreme red and infra-red radiations extending between 7,400 and 9,500 A. U.

While the total number of flowers thus photographed is not large (43), the remarkable uniformity of the results so far obtained with corollas of every genus, leads us to believe that the great differences in the reflective power of flowers, for those wave lengths which correspond to visible and ultra-violet lights, come to an end, almost abruptly, in the invisible infra-red. Between 7,400 and 9,500 A. U. corollas of every color reflect most of the radiations which strike them, and, so far as we could observe, do not practise on them the intense selective absorption which causes the beautiful colors of flowers in visible light. If our eye were sensitive to every one of the radiations found in sunlight, flowers of all colors, when illuminated by the beginning of the infra-red exclusively, would probably give us the impression of a highly luminous white.

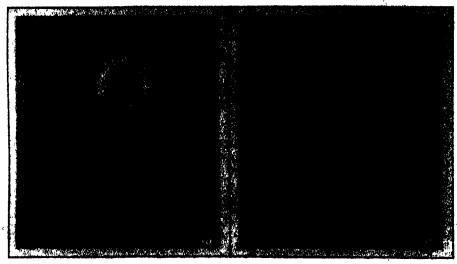


Fig. 10.—Ultra-violet, and, Fig. 11, visible light photographs of the upper and lower faces of a dandelion.

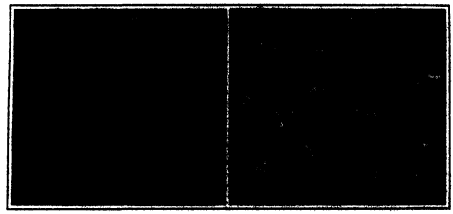


Fig. 12.—Visible light photograph of seventeen varieties of pansies.
Fig. 13.—The same, in infra-red light.

Coal-tar Dyes

THE present crisis in Europe has practically cut off the supply of coal-tar dyes which this country has been importing from Germany, France, and Great Britain, and the question arises, can the United States manufacture a sufficient quantity of these dyes to meet the demand? Another point to be considered is the return to be expected on the capital invested should the United States succeed in transplanting the artificial dyestuff industry from Germany to this country.

There are to-day in the United States nine factories which produce coal-tar dyes, but these factories are dependent upon Germany for the raw material they employ. A sufficient quantity of coal-tar could be produced here to render the aniline dye industry independent of the foreign tar supply, but the domestic producers of such raw materials can obtain higher prices for them from other sources than the artificial dye industry could pay.

As Dr. Bernhard C. Hesse pointed out in a lecture at the College of the City of New York, on May 1st, 1914, "Germany is supreme in the coal-tar dye industry, because (1) Germany was the home of the industry; (2) the industry itself is so dependent upon interlocking chemicals and the growth of this interlocking dependence has been as fast as economic development warrants and has now reached such a stage of complexity and interdependence that it is difficult of transplantation as a whole; (3) there are relatively few so-called staple articles among the coal-tar dyes—by staple is meant those which are consumed in quantities to be measured by tons—many of those few are so interlocked with subsidiary or by-products that the transplantation of the work out of Germany would be economically unprofitable. Wherever it has been profitably transplantable to this country, the manufacturing of such staples has been done, and with considerable success, even though the raw material supply is still provided by Europe."

In 1912 Germany had a total of 5,319 stock com-

[illegible] in Germany in 1913, which represented [illegible] of the capital stock. Ninety per cent of the [illegible] dyestuffs manufactured in the world are [illegible] many, and Germany has three times as much [illegible] dyestuffs to sell for every dollar's worth [illegible] at home.

The coal-tar dye industry, if transplanted to the United States, must be prepared to meet the fact that Germany has said that she would sell for any length of time at cost any of the dyestuffs made in Germany, if necessary to crush the industry with the production of 700 different aniline dyes would necessitate the introduction of 700 different sets of operations and about 700 different sets of apparatus. The entire United States consumption would not employ more than 7,000 persons and represents about 0.4 per cent of our total import business.

The possibility of the United States' competing with Germany in the manufacture of artificial dyes has been carefully considered by both capitalists and chemists long before the present emergency, say for the past 10 years. The industry has been developed in Germany to such an extent and refinement that Germany is wholly independent of sources outside of her own boundaries. While no one of the German factories is entirely independent of the others, taken collectively, they are not dependent upon anything outside of German soil. It would not be possible to duplicate elsewhere the conditions in Germany over night. To produce a complete and self-contained artificial dyestuff industry in this country and to produce it at once would call for the investment of capital far in excess of what the distant dividend would seem to warrant. To plan and erect the necessary buildings and machinery would require a full year.

During 1913 the total importation of artificial dyestuffs into the United States has amounted to $7,105,264. This was exclusive of alizarine dyes and indigo. During the census year of 1910 (the latest available figures) this country manufactured $3,462,486 worth of artificial dyestuffs, about 32 per cent of the country's consumption of aniline dyes, but the bulk of the raw materials used in the manufacture of those aniline dyes in the United States is obtained from Germany and England. And until the United States can be sure of producing the necessary raw materials at a price which will enable the color industry to purchase them here and still be assured of a reasonable profit on the finished product, the financial aspect of developing the coal-tar dye industry to the point where the United States can supply her own needs will remain questionable.

In the past thirty-six years there have been taken out in Germany 8,062 patents on the utilization of coal-tar hydrocarbons and their by-products. Out of these but one in every hundred, it is authoritatively said, has secured financial returns for its owners. Not all the work on coal-tar dyes which has been done in Germany has been profitable. But out of the years of painstaking research work and aggressive merchandising has grown an industry which is second to no other of its kind in the world.

American brains and American capital doubtless could develop a coal-tar dye industry which could supply the requirements of this country in artificial dyes, and possibly compete with Germany in exports, but the return on the capital invested would not be sufficiently attractive in comparison with the return which might be obtained in other fields that it would not be desirable to attempt it. And one other thing must be considered, namely, when the present war is over Germany will make every effort to regain the ground she has lost industrially and would undoubtedly sell at a very close margin, possibly at figures which would make American competition unprofitable, if not impossible.

To Harden the Surface of Concrete Floors

CONCRETE floors in factories do not always stand the wear, so that the new treatment now current in England should become better known here. A mixture of 15 or 20 pounds of iron dust or filings with 100 pounds of cement is added to twice that much sand and applied as a top coat, nearly an inch thick. It is said to be hard, very durable for heavy wear, waterproof, and not slippery.

Our Merchant Marine, Past, Present and Future

II. The Present

By Winthrop L. Marvin, Author of "The American Merchant Marine. Its History and Romance"

A PREVIOUS article has outlined the notable growth of the American merchant marine in overseas trade from the first navigation acts of Washington onward, the decreasing tonnage of the years between 1826 and 1861, and the long decline that followed. When the great European war broke out last month, the American tonnage registered for overseas carrying was 1,019,-686, an amount scarcely greater than the 981,019 tons of one hundred and four years ago—1810. But even this figure of 1,019,686 tons is deceptive. It includes a great many small craft that perform what is practically a ferry service to Canada or ply upon international rivers like the Yukon. It includes, moreover, many large ships that have been engaged in coastwise commerce by way of the isthmuses of Panama and Tehuantepec, or via the Strait of Magellan—ships that will now pass through the Panama Canal. These vessels convey cargoes that are chiefly or altogether American, between the Atlantic and Pacific ports of the United States. Because these voyages carry them by the shores of foreign countries, they find it convenient to sail under foreign trade register instead of coastwise enrollment. Besides, there are other vessels engaged only casually or for a part of the year in foreign commerce.

It is probable that all American shipping, steam and sail, employed regularly and exclusively in overseas traffic with other nations would not now exceed 600,000 tons. This tonnage sufficed in the last fiscal year to carry only 8.9 per cent of the seaborne commerce of the American people, or a value of only $361,032,495, as contrasted with $3,392,028,420 conveyed in foreign ships under the flags of foreign governments. The cost of carrying the mails, passengers and merchandise in the import and export trade of the United States is estimated conservatively at between $200,000,000 and $300,-000,000 a year. At least nine tenths of this vast sum is engrossed by the shipowners of Europe and Japan, stimulating the shipbuilding and navigation of our rivals in trade and possible enemies in war, who are thereby enabled to maintain their auxiliary navies in large part at our expense. In our time of need, we have just seen how quickly these alien auxiliaries leave us—ships and men alike.

Existing American steamship services to foreign ports beyond those immediately adjacent to our ports are so few that they can easily be enumerated. First, there is the American Line to Europe—four steamers, the "New York," "Philadelphia," "St. Louis," and "St. Paul," subsidized for carrying the United States mails under the law of 1891. Then there are two steamers of the Red Star Line, the "Finland" and "Kroonland," built in anticipation of the passage of the Frye-Hanna subsidy bill of 1901-1903, transferred for economy of operation to the Belgian colors, and since brought back to the American flag for prospective coastwise service through the Panama Canal. Six ships thus make up the whole American fleet regularly employed in scheduled service to European ports.

In the trade to the West Indies and the Caribbean region, the Stars and Stripes hold a position of some dignity and power. The New York and Cuba Mail Steamship Company (Ward Line) performs a postal, passenger, and freight service from New York to Cuba, the Bahamas and Mexico, with nine or ten American steamers of excellent speed and adequate tonnage. Like the American Line to Europe, the Ward Line is subsidized under the Ocean Mail Act of 1891. So is the Red D Line of four ships, from New York to Venezuela *via* Porto Rico. Our one government-owned steamship line, the Panama Railroad Company's service, has been operating seven steamers from New York to Colon. The Clyde Line operates five ships from New York to Santo Domingo. The Southern Pacific sends a few steamers from Gulf ports to Cuba. The United States Steel Corporation has been exploring under charter those American ships of the great coastwise fleet of the American-Hawaiian Company, from New York to Brazil.

In the Pacific five American steamers of the Pacific Mail run from San Francisco across the Pacific *via* Hawaii to Japan, China, and the Philippines. One American steamer of the Great Northern Company runs from Puget Sound to the Orient. The re-established service of the Oceanic Company or Spreckels Line, with three steamships, extends from San Francisco to Australasia. Smaller vessels of the Pacific Mail operate from San Francisco to Central America and Western Mexico.

This short list comprises the American steamships now actually employed in foreign trade on August 1. There is, however, American sail vessels of a small though varying number are still employed in foreign voyages in the Atlantic and Pacific, and from time to time individual American "tramp" steamers of the coastwise fleet—a useful type and increasing—are chartered for cargoes overseas. But altogether, American participation in ocean commerce away from our own shores long has been and is so slight as to be a cause of mortification and loss to the United States.

It is significant that four of the few American steamship services to foreign ports—the American Line to Europe, the Ward Line to the West Indies and Mexico, the Red D Line to Venezuela, and the Oceanic Line to Australasia—are in the receipt of mail subventions or Government encouragement. The law of 1891, under which these lines are operating, is, therefore, responsible for the greater part of the present regular steamship service under the American flag to other countries. The Pacific Mail is maintained as a matter of pride or tenacity of purpose by the Southern Pacific Railway, which has long controlled it; for it yields no dividends, and can expect none, so long as it is paralleled by subsidized Japanese and British competition.

This Ocean Mail Act of 1891 has justified itself and would have been much more successful if the original rates of compensation—comparing not unfavorably with what is paid for similar service by foreign governments—had not been ruthlessly slashed on the enactment of the law by the insistence of the agricultural South and West in Congress. Every effort to restore the original rates, as recommended by Presidents Roosevelt and Taft, to provide new lines to South America and the Orient, has been defeated by narrow majorities in Washington, through blind and narrow opposition from the same sections to which the European war has at last brought a new realization of the national value of an American merchant marine.

Lacking national aid to overcome disparity in construction costs, wage maintenance costs, and foreign subsidies to swift regular services on many routes, American shipowners, though as enterprising and courageous as other men of their race, have not been able to increase our actual overseas fleet, even in past years of high national prosperity. Not one ocean ship has been built in the United States exclusively for foreign commerce since the "Saratoga" and "Habana" were launched for the Ward Line, in 1907. American shipbuilding and shipowning for the overseas trade have been, since then, an industry of absolutely arrested development.

This fact led to the inclusion in the Panama Canal Act of 1912 of a new departure in American maritime practice—the opening of American registry to foreign-built ships not more than five years old, to engage in foreign commerce. But though this free ship provision went into effect at a favorable period, when the ocean-carrying trade was generally active and profits were high, not one ship of any kind was brought under the American flag in consequence, thus demonstrating that a free ship experiment in itself is futile, without some more positive legislation to reinforce it.

Contrary to an impression which the foreign steamship interests carefully inculcate, the ocean-carrying business, as a whole, is a reasonably profitable business. Dividends of 7, 8, 9, 10, or 12 per cent have been paid of late years by some of the world's chief shipping companies. Foreign capital finds it advantageous to build and operate an increasing fleet of ocean ships, and, what is more, a very large amount of American capital, estimated at between $100,000,000 and $200,-000,000, has been invested in the ocean trade, under foreign colors. The problem of the American merchant marine of the future is essentially how to make shipping yield returns under the American flag equal to those yielded under foreign colors. If great sums of American money are ventured in ownership and operation of foreign vessels over which our Government has no control, it stands to reason that under equalized conditions American money should even more easily be secured for ocean investment beneath the American flag, which could protect American property without explanation or embarrassment.

When the Congressional Merchant Marine Commission, of which Senator Gallinger was chairman, under President Roosevelt's administration, asked representative bankers and merchants of the seaboard if American capital were ready to embark in the ocean shipping business if the costs of construction and of operation could be equalized with foreign flags, the unanimous reply was that the requisite capital would be forthcoming. Since that time there has been an enormous increase in the capacity and value of our coastwise shipping, the branch of our merchant marine where fair profit is possible, and the new steamers of the Panama Canal fleet particularly have been built on designs adapting them to world-round service

There is money enough in the country, and there are the men. A very great part of the American race is a sea-loving and seafaring race, by tradition and environment. It is not essential to the development of an American fleet in foreign trade, any more than it is to the development of any other national industry, that none but American citizens should be employed in the business But the number of American citizens actually employed under the American merchant flag is very much greater now than twenty years ago Then only 30 per cent of the shipments by United States Commissioners of crews of merchant vessels were of citizens of the United States Now the citizen proportion so shipped has advanced to about one half, the native-born heavily predominating In 1903 the American citizen shipments were 59,498, in 1913, there were 95,820

A recent critical study of American ocean shipyards by a British observer has produced the judgment that these American yards stand in the very first rank, in the technical skill and executive ability of their staffs and the completeness of their equipment. The yards which built and engined the American battleship fleet in its around-the-world voyage—an exploit never attempted by so many heavy ships under any other flag—need no further encomium.

The United States has a vast foreign commerce of a value of four billion dollars a year, which could be swiftly and greatly increased if the nation possessed its own sea delivery wagons instead of depending upon jealous competitors for this vital service A question of supreme importance to the American people is, How can American ships, the delivery wagons of the ocean, be most surely and quickly secured?

(To be concluded.)

Molding Brass Pieces

IN some of the modern European electric construction works, molding machines turn out millions of small brass pieces such as the industry requires Compression of brass pieces in steel molds has now supplanted the old method of casting, for turning out such pieces in brass or bronze. Formerly a sand mold had to be made for each piece, but now a single steel mold serves for thousands of pieces In this process are used brass bars whose section is chosen after experience so as to be best adapted for shape and size of the finished piece, then a section is cut off the bar to length, and the piece is heated to redness in a furnace, then molded at high pressure in the steel mold A pressure of a few seconds is enough to produce the required shape, and it is found that pressure makes the brass more compact and solid As the steel mold can be made exact to a small fraction of an inch, the products have very close sizes for use. Even pieces which formerly were cast in bronze, such as shaft bearings, are now made by the molding process.

The Current Supplement

THE current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2023, for October 10th, covers a wide field of information The description of the 'Parseval' airship, by a specialist personally familiar with its details, is particularly timely, as is also the description of the Rumpler monoplane, adopted by the German government. The article on Germplasm as a Stereochemic System disclosed a new line of research of intense interest The discovery that the toxic principles of venoms of serpents are albuminous has led to the further discovery that these terribly lethal substances are proteins, and that, apart from their toxic properties, they are indistinguishable from corresponding bodies that are ingested as food or found as normal constituents of living tissues generally; and this time has led to the conception that in different organisms there are correspondingly complex organic substances which are not absolutely identical in chemical constitution, and which may exist in countless modifications, each characteristic of the form of protoplasm, the organ, the individual, the sex, the species, and the genus. Coal-tar Products in Medicinal Use tells interesting facts about some newer medicines, and the Physiological Standardisation of Drugs is an interesting account of how the strength of powerful drugs is established, and the proper doses determined. Stress Distribution in Materials contains many valuable suggestions to all who are engaged in engineering projects, and there is also the usual selection of other interesting matter.

Coaling a United States Battleship

A Dusty and Dirty Task That is Rushed Through With Great Dispatch

ALTHOUGH the job of coaling ship is one of the dirtiest and most unpopular jobs that falls to the lot of a ship's company, it is always rushed through with energy, and haste is made with the holystone, the brush and the hydrant, to restore the much-begrimed ship to its chronic condition of spick-and-span order and cleanliness.

The matters of coal supply, coal capacity, and speed in coaling ship, are among the most important of those affecting the efficiency of a navy. No thoroughly satisfactory method for coaling ships at sea has been devised; that is to say, one that will enable a ship to be coaled in a sea-way, and hence it is necessary when bunkers have to be replenished to send the ship to some sheltered waters, where the colliers can lie alongside and put the coal aboard without any injury to collier or warship. This, of course, necessitates the ship's leaving its station with the fleet for a considerable length of time, with the result that the active line is temporarily weakened to that extent. Consequently, every effort is made, in the construction of the bunkers and the coal trunks thereto, in the appliances for transferring the coal from the collier to the ship, in training of the crew to shovel the coal from the deck to the trunks leading down to the bunkers, and rapidly to stow it, so that the whole operation of coaling may be got through with the least possible loss of time.

There is no navy in the world which has devoted so much attention to this matter as the United States Navy; and the department has designed a fleet of large colliers, of great coal-carrying capacity, good speed, and provided with the most modern coal-handling apparatus, which have served greatly to increase the mobility of our fleet, by rendering it less dependent on coaling stations.

Although coaling ship is an exceedingly dusty, dirty and uncomfortable job, calling for a large amount of subsequent cleaning up to make the ship presentable, there is keen competition among the individual ships of the fleet in the effort to obtain a high record for speed of coaling. As an instance of what may be done, we quote the case of the "Georgia," one of our earlier pre-dreadnoughts, which is credited with having stowed in her bunkers 468 tons in one hour, and the dreadnought "Arkansas," one of our latest ships, whose crew stowed as much as 860 tons of coal in the hour.

Previous to the year 1908, the navy possessed about a dozen extemporized colliers, some of which had been built in this country and some abroad. They were ships of moderate coal-carrying capacity and their coal-handling apparatus was of limited efficiency. Since 1908, the department has designed a very fine fleet of large colliers, equipped with the most modern coal-handling apparatus, which have increased the mobility of our fleet—a subject to which the Navy has given much attention. The first of these, the "Prometheus," has a capacity of about 6,000 tons of coal. This was followed in 1909 by the "Hector," "Mars," and "Vulcan," each carrying a cargo of 8,200 tons of coal. In 1910 and 1912, we built the "Cyclops" and "Jupiter," large ships of nearly 20,000 tons displacement and 14 knots speed, carrying a cargo of about 10,500 tons of coal and nearly 3,000 tons of oil. Of about the same capacity are the "Neptune," 1911; "Proteus," 1912; "Nereus," 1913; "Jason" and "Orion," 1914. All of these ships are of 14 knots speed, and they are equipped with the most up-to-date unloading gear. We have also under construction two oil fuel ships, the "Kanawa" and "Maumee," 14,500 tons and 14 knots carrying 7,564 tons of oil fuel.

When a warship is to be coaled, a collier, or two of them as in the case shown in our illustration, are brought alongside, the booms are lowered until they cover the warship coal trunks leading to the bunkers, and the delivery of coal commences and is carried on continuously until the full load has been delivered. The gear consists of a series of cableways, leading from the central A-frames of the collier out to a corresponding series of booms that are lowered above the warship. One-ton clam-shell buckets pick the coal up from the collier's hold, run it out over the warship and dump it into the chutes leading from the deck to the bunkers. Sometimes, when the unloading capacity of the collier is greater than the receiving capacity of the ship, the coal is deposited in large piles on deck, as shown in our photograph. The seamen turn to and shovel the coal down into the coal chutes, and a large force of trimmers in the bunkers below stow it snugly.



The dreadnought "Arkansas" has a record of having stowed 860 tons in the bunkers in one hour.

The navy colliers "Nereus" and "Jason" coaling a United States battleship.



Photographs copyright by E. Muller, Jr.

Note the ship's band on the top of a turret, and the huge pile of coal dumped on deck by the shoveling into the chuting trunks leading down to the bunkers.

Scene on the deck of a battleship during coaling operations.

Sewing Broken Bones With Bone Pegs

By Dr. Leonard Keene Hirshberg, A.B., M.A., M.D. (Johns Hopkins)

UNTIL a few short years ago there was no new thing under the sun as far as broken bones were concerned. When the Egyptian mummy cases were opened, the broken bones in them, some six thousand years old, were found to be in splints much the same as those of to-day.

Plaster casts, wood splints, and all of the surgical bone procedures of nowadays are to be seen in the remains excavated from ancient ruins.

But along came a few surgeons two or three years ago and startled the old, complacent, satisfied fogies, and said: "Surely there must be a quicker and better way to link up the ends of broken bones." So they sat down and schemed out a new method.

They realized that since Pasteur and Koch had found out the causes of blood poisoning, to wit, not dirt, dyes, sewer gas, and humors, but bacteria, all that is necessary to do now in order to take hold of the ends of the bones and bring them together, is to open an arm or a leg, just as the belly is opened for an appendicitis operation.

That is to say, by freeing the flesh and bones of all danger from lurking, dying, jumping germs, the surgeon may now do wonders with broken bones, instead of dallying and delaying with jackets, casts, and splints, or blaming the slow healing upon that scapegoat of ignorance called "*nature*."

When the young and dashing surgeons defied medical stand-pattism and officious inactivity by the proposal to actually cut into every broken bone and literally to stitch it together as you would a mattress or a split skirt, some of them were ejected from medical societies or otherwise pestered or interfered with.

Yet the curious part of it all is the fact that no physician thought of this sooner. There they were sawing open the skull, pasting up the brain, gluing together torn nerves, basting the macerated appendix, and doing odd jobs on all the internal structures of your melancholy anatomy, with never a thought of danger to you, yet they forgot the ribs, the shoulder blade, the funny bone, and the housemaid's cracked knee.

Comes now Prof. Charles Donson, the distinguished surgeon of the Illinois University Hospital, Chicago, with an ultra-modern and super-novel way in which to hurry the healing of the hurt humerus, leg bones, shin bones, or any other bone.

When a simple fracture of a long bone is fixed by splints as physicians do, and have done for millenniums, the internal bone-marrow begins to help to form a plug between the broken ends to hold them in place. In the physiologic way of healing the bone, this internal, natural splint, says Prof. Donson, is the main spring and stronghold of the newly formed bone.

If this method of living tissue were imitated by the surgeon, according to the excellent results obtained by the Chicago surgeon, broken bones would be as snug and tightly healed very quickly instead of incapacitating the victim for from six to twelve weeks.

Your earning power and efficiency would be vastly increased, and broken limbs would be quickly forgotten.

Prof. Donson has succeeded in effecting this very thing. If you break your arm, wrist, ankle, leg, or what not, and fall into the hands of a skilled surgeon such as Dr. Donson, he will do as he describes of a number of recently and rapidly recovered patients, namely, cut open the parts, go right down to the bone, and insert pegs of your own or frozen bone saved for just such emergencies, as a "couple" between the broken parts.

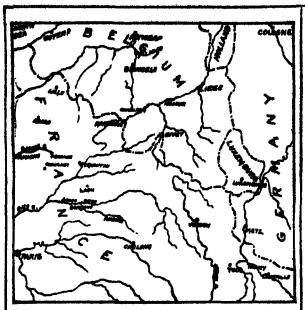
Six patients with fractures of one sort and another of the elbow, forearm, thigh, hip, and other sections of the skeleton had the broken bones thus "sewed together." Pegs or splinters of bone were taken or "sliced off" from bones nearby, and these were inserted into the middle or marrowy parts of the fractured segments.

Thus, almost instantly, without the tardy methods of nature, but by the artifice of Prof. Donson, those with broken legs who would have been laid up, as is now generally true, for two months or thereabout, were up and walking upon the broken leg in from three to four weeks.

This discovery is a vast advance even upon sewing up the broken ends. In the latter step, which is also a progressive one over the old way, the bone is held nicely in place by the stitches, but there is no support for new bone to hasten the restoration to normal.

In Dr Donson's procedure, the basis is there in the form of a splint that can be used as food, soil, support, and first aid. Moreover, it becomes a part of and is fused with the new bone.

The Owner Checks Up the Automobile.—A patent, No. 1,109,191, has been issued to Frederick A Wieland, of Chicago, for a construction for preventing the overspeeding of automobiles, which includes a casing containing tokens, a certain number of which are stored under lock in the casing and are automatically discharged when the machine exceeds a certain limit so that the owner can, by observing the number of tokens discharged from the case, keep a check on the manner in which his car is being operated.



Map of the western frontier where the allies and the Germans are now deadlocked.

The War in Europe

Letter from the Military Expert of the Scientific American, October 1, 1914



The eastern frontier where Russia is contending with the Austrians and the Germans.

The Campaign in France.

WHEN the British and French found that the Germans were strongly entrenched along the Aisne River and to line southeastward to Alsace, they had to choose whether to attempt to pierce the German center at enormous expense in lives, or to force them back by working around a flank to a position from which they could threaten their lines of communication

Time is not a necessary element of success for the Allies; indeed, any delay in the decision of the campaign redounds to their advantage. Germany and Austria have reached the full development of their military strength, as have France, Servia, and Belgium. Russia will hardly get her armies at the front fully organized before November, while Great Britain is only about half started. Every day will then see the numerical advantage of the Allies increased.

An attack through the center has much more decisive results if successful than one around the flank. By separating the opponent into two parts his co-ordination of strength is destroyed. The parts of his army lose to some extent their power to support each other; the assailant in a central position can concentrate his army first in one direction then in the other, destroying his opponent in detail

This is the position at which Napoleon aimed in all of his campaigns, and his success in attaining it was responsible for most of his victories. At Austerlitz in December, 1805, he allowed the combined Austrian and Russian armies to surround his right flank Then checking this turning move with one corps, he launched the Guard corps and those of Soult and Bernadotte at the opponent's center, broke through, turned south and destroyed the Austrian and Russian forces that had been threatening his flank.

It was this strategy that dictated the French advance against the German Fifth Army under the Crown Prince in the Argonne Hills, northwest of Verdun. These hills had tended to separate the fourth and fifth armies during their retreat, the fourth army being supplied from Sedan and the fifth from Luxemburg. The Germans discovered the danger and rushed up reinforcements that re-established a strong connection between these two armies. The French and British then fell back on the turning move around the German west flank to obtain their object of forcing the Germans to evacuate France

The first move was to push forward on the north side of the Oise River a newly organized army of reserve corps under Gen d'Amade. The Germans discovered this move and rushed forward reserves, gathered in garrison detachments, and formed an army under Gen. von Boehm to extend their right flank. The French advance penetrated as far as St. Quentin, where its advance guard was driven back by the Germans. A further reinforcement of Gen von Boehm's army by troops reported as withdrawn from the German center enabled him to force Gen. d'Amade's army back 15 miles, nearly to Bray on the Somme River.

Detachments of the Allies have appeared in force far to the north of this district on the line between Arras and Lille. These could not be so far advanced unless supported by larger bodies in the rear, possibly the new British army that is rumored to be landing at the Channel ports. Unless the Germans can check this threatening move they will have no choice but to retire to a less exposed position.

In order to relieve pressure on their western flank the German sixth army, composed of the Bavarian corps, under their Crown Prince, advanced against the strong line of forts south of Verdun and broke through to the Meuse River. This move was not sufficiently supported, and was taken in flank by a French army from Toul, forcing its retirement from its advanced position.

The success of the German heavy siege guns in reducing the French fortifications is one of the notable features of the war, but is only a repetition of their tactics in 1870. By taking into the field the largest howitzers used up to that time they forced the surrender of sixteen French fortresses by bombardment alone. Four were given up without defense, and five were captured after siege.

The explanation is that these present forts were constructed nearly a generation ago, prior to 1890, when the 21-centimeter mortar was the largest gun considered sufficiently mobile for use in the field. Masonry arches were made 2.5 meters thick, and the steel cupolas were given a thickness of 20 centimeters. Dictates of economy prevented the national legislatures from appropriating the funds needed to strengthen the defenses against the ordnance developed in recent years.

Roughly speaking a shell is effective against a thickness of chilled steel equal to its caliber and against ten times its caliber of concrete. The Germans profited by the Japanese success in using heavy seacoast 28-centimeter howitzers in their attacks on the Port Arthur forts to develop a lighter type of this gun that can be transported under favorable conditions. By the above rule it is effective against 28 centimeters of turret or 2.8 meters of concrete. Wherever it can bring its fire to bear this gun can batter to pieces the older type of fort.

The French defense has to rely on strengthening the fortifications by added earthen parapets, on the placing of heavy guns for counter firing, and on the operations of their field armies to hold off the German attacks.

The Russian Campaign.

The Russian plan of operations consists of a defensive campaign in the north, while they push the campaign against the Austrians. The German army of Gen. von Hindenburg has successfully pushed its advance from East Prussia until the Russians have been forced back to the Niemen River. It is important to the Russians to hold this line to protect their rail routes lying behind it, so they may be expected to rush forward reinforcements until the German invasion is held to this line.

In Poland the Russians are slowly concentrating armies to force back the German invasion of the western provinces. This is the line of advance that most threatens German territory. Both through East Prussia and through Silesia the Russians will be opposed by fortified lines that will greatly delay their advance. By making their projected invasion through Poland they turn both of these obstacles and arrive directly upon Central Germany.

In Galicia the overpowering Russian advance has forced the Austrians to abandon seven eighths of the province and to fall back toward Cracow. This move steadily shortens the front that they have to defend and brings them within supporting distance of the German army in southwest Poland.

The Austrian holding of the line from Tarnow to Sanok was largely a rear guard position to protect the above withdrawal. The position now occupied, north and south through Tarnow, makes them the right wing of the combined armies stretching from the Carpathians to the Black Sea. The Russian plan of operations against this strengthened resistance seems to be a continuation of the attacks upon the Austrians in the effort to break down their resistance before they can reform.

Geared Turbines and Electrical Propulsion

THE subject of the geared turbine was referred to in our last Engineering Notes, and we then mentioned that certain developments regarding this type of machinery were in progress in America. This has prompted a patriotic correspondent, Mr. William P. Durtnall, to point out that the system of propelling vessels by means of rotary steam engines or turbines combined with mechanical speed reduction gear for driving screw propellers for ship propulsion cannot be claimed by the Americans as a special "system" of their own, seeing that this system was the subject of a British patent granted to Mr. Joseph Bramah, an engineer, of Piccadilly, London, as far back as May 0th, 1785, which patent can be examined at the British Patent Office, off Chancery Lane, to-day.

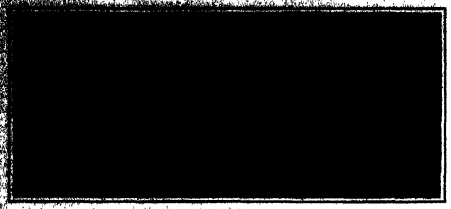
Mr. Durtnall, whose work on the electrical propulsion of ships is so well known, states that the system of geared turbines adopted in America on the collier "Neptune" is substantially the same as that which he himself proposed many years ago for the purpose of reducing the steam consumption of steam turbines, and it was only on reference to the above-mentioned patent of Mr. Bramah's that he did not lay claim to it, as it was obvious that anyone could use it, as the "patent" has now been public property for about one hundred and fifteen years.

A further interesting reason that caused our correspondent to seek fresh fields of investigation into marine propulsion systems, apart from that of the geared turbine, was that he held to be dangerous the heat generated in the gearing of big power units—dangerous because of the fact that the mineral lubricating oil which is used in the gear reduction cases may form into an inflammable gas. Men have even been killed through the explosion of gasified lubricating oil arising from the crank-chambers of large Diesel engines, and a similar peril may arise in connection with geared turbines; in any event, one observes large notices, "No smoking is allowed," in the engine rooms of most geared turbine ships.

The whole question of new methods for the propulsion of ships is so vitally important in all its details that the American Government caused to be built, and has conducted experiments upon, three sister ships with a view to settling the question of the most satisfactory propulsion system. These three ships have just the same boiler capacity, the only difference in the design being the actual method by which their propellers are driven.

Of these vessels the "Cyclops" is the best type of reciprocating steam-engined ship of the same speed, displacement, and revolutions per minute afloat. The "Neptune," to which we have previously referred, has geared turbines, and the "Jupiter" is propelled on Mr. Durtnall's polyphase alternating current system, which was first described in 1908 at the Franco-British Exhibition Meeting of the Institute of Marine Engineers. The "Jupiter" has twin screws driven by electric motors developing 6,940 horse-power, a turbo-generator supplying the necessary electricity.

All these ships have now been through their official trials, the average speed during forty-eight hours being 14.6 knots in the case of the "Cyclops," 13.8 knots in the case of the "Neptune," while 15.1 knots was the figure of the electrically propelled "Jupiter," which thus easily surpassed the contract speed of 14 knots. The steam consumption of the last, of 21.4 pounds per shaft horse-power at 115 revolutions per minute, is claimed to be about 20 per cent lower than that of the very best type of steam-engined ship afloat.—*The Daily Telegraph.*



Overloaded in front.



Clearing the water.

Further Flights with Langley's Aeroplane

By Our Staff Correspondent at Hammondsport

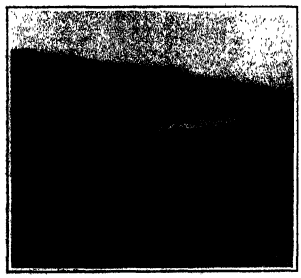
AFTER rehabilitation and first trials, at the Curtiss aerodrome on Lake Keuka, N. Y., of the great Langley monoplane of 1903 were described in the SCIENTIFIC AMERICAN last June. The tests showed that this scientifically designed pioneer flying machine was capable of flight with precisely its original propulsive plant, wings, and rudders, and with 40 per cent additional aggregate weight, due to floats and extra framing to attach them. Then the trials were temporarily halted in favor of the elaborate and feverish experiments with the "America," the Rodman Wanamaker transatlantic flyer. The Langley was unwinged and stored nearly three months in the hangar at the lake side.

Toward the middle of August Mr. Curtiss went to California, leaving further tests of the big monoplane in charge of his mechanicians. He had instructed them to mount one of his 90-horse O. K. motors with a direct-connected tractor screw on the fore part of the aeroplane frame, and to set aside for the present the original motor and twin propellers. As these had several times driven the machine in short flights, he saw no advantage in making them continue to bear a 40 per cent extra burden, especially as the ball-bearings of the propeller shafting never had been over strong for their normal work. In case of wreckage he would feel far less keenly the loss of a regular stock motor than the loss of that splendid pioneer engine, so much admired for its workmanship, and which truly may be called the first gasoline motor in history, adequate to carry a man in sustained mechanical flight. Moreover, he had from the beginning intended to use a Curtiss motor, but had not at first hit upon a simple way of mounting it and keeping the propeller free of the front stay wires.

As the chief designers and constructors at the factory were now very busy, the adjustment of the new motor and propeller, to the aeroplane, was left to a practical mechanic who worked at the job leisurely during his spare time. None of Prof. Langley's nice computations and preliminary studies were attempted. The machine was "balanced up" as a farmer balances hay on a wagon, by looking at it from different sides and applying horse sense. Presently the craft was placed on the water and moored, with a rope and spring-balance, to a stake on the shore. The propeller gave a static thrust of 410 pounds. Maybe that would do; if not, the screw could be quickly removed and one, two or three others, taken from stock, could be tried in turn. While the propeller was spinning, it sucked up water from the lake and blew a cold spray over the bystanders. Frank Kleckler, the practical man in charge, put on his raincoat and finished the measurement. He now had the Langley ready for its wings and for its first run.

In the absence of Mr. Curtiss, his aviation instructor, "Doc." Wildman, piloted the aeroplane, with its new motor. Seated above the main frame, behind the front wings, he ran the craft cautiously over the lake, while some of the factory men and Dr. Zahm of the Smithsonian Institution accompanied it in a motorboat to observe its running balance. The pontoons were too far back, the weight too far forward, the rear wings set at too large an angle. The latter difficulty had been foreseen by Prof. Langley, who had provided notches for fixing the leading edges of the wings as high or low as seemed necessary. When the angle was lowered and the pilot and pontoons shifted along the frame, as a grocer slides weights along the beam of his scale, another run was made, resulting in several short flights. "Doc." Wildman was then called to California, and was succeeded by one of his pupils, Mr. Elwood Dougherty.

After some little "tooling out" of the machine, Mr. Dougherty notified the photographers of his intention to attempt a flight. Waiting till they were a thousand feet from shore in a motorboat, he started from the aeroplane to overtake them. The Langley, with its swollen wings gleaming bright yellow in the clear sun, and the floats skimming lightly with foaming beaks, sped forward in powerful poise, cleaved the water near the camera, and headed half a thousand feet forward at an elevation of three or four yards. The flight was thus recorded, and the craft was then returned to



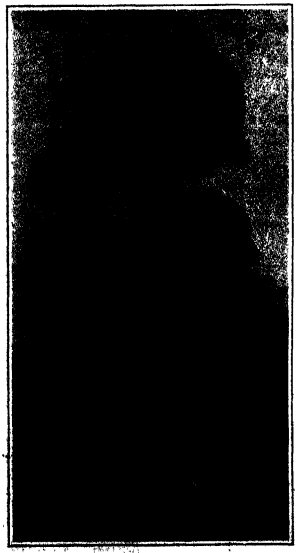
The machine climbing.

shore for a longer voyage, as soon as a larger propeller could be added. A light breeze, not quite strong enough to raise white caps, was blowing during the trial.

Two days later some better results were achieved. The pilot had said the craft was in easy control, but mounted too readily and lacked thrust. Accordingly the front wings were lowered from an angle of 12 degrees to one of 10 degrees, and the 8.5-foot screw was exchanged for a 9-foot screw. The rear wings were left at about 10 degrees angle of incidence. When the photographers were again in place, the shining craft tripped lightly over the sunlit waves, and slid gracefully into the air in excellent poise and at a speed neighboring 35 miles an hour. Hovering within ten yards of the water, it ascended on a very easy grade, soared along 3,000 feet, declined to the wave tips and soared again 2,500 feet. Both on the water and in the air its movement was stable and majestic.

In all the foregoing experiments the aeroplane when fairly adjusted maintained a secure and steady poise, both in planing and in flying. By virtue of the dihedral angle between its wings it possessed good inherent lateral stability. No wing-warping or aileron attachment had been provided by Prof. Langley, and none was used either at present or last spring. True, Langley had placed well below the main frame a wind-vane (vertical) rudder, which could be made to exert a righting as well as a steering effect, but neither Curtiss nor his men ever employed this rudder since the first brief flight in June. It was, in fact, tied fast and remained inactive. In its stead the big tail was used to steer right and left. The big tail was used also as an elevator, as in Langley's day. The reason for steering with the tail instead of the wind vane rudder, as in Langley's scheme, was to secure a more powerful hold on the wind while the craft was running on the water. Once aloft, the little rudder could, if put to use, very well steer the machine, as Langley intended.

At the conclusion of the last trial, toward the closing hour on Saturday, September 19th, the Curtiss workmen volunteered their services for the morrow. They wished to see the aeroplane, after a slight shifting of the pilot's seat, fly several miles and cut figures in the air, before the rough autumnal winds should begin. But their superintendent, Mr. Kleckler, thought it best for them to rest on Sunday, and chance the weather following. Unfortunately the stormy weather came before the long flight could be attempted, and the scientific observations that were to attend it.



Dressing off the board marks from a concrete wall.

Power-driven Hand Tool for Surfacing Concrete

IN the construction of concrete walls and ceilings, board marks are left on the surface, and have to be removed. Ordinarily this is done by hand. A carborundum stone is rubbed over the surface and water is used to clear away the grit. This results in forming a paste or mud which, by the action of rubbing, is ground into the wall, leaving an unstable material in the pores, and giving the surface a streaky appearance.

Recently a power-driven hand tool has been invented for removing the board marks. This works dry, and it leaves the surface slightly porous, so that it provides an excellent base for the application of a float or a coat of paint. The machine is driven through a flexible shaft by a motor carried by the operator. The whole apparatus, motor included, weighs only 20 pounds. The motor may take its actuating current from an ordinary electric light socket.

The surfacing tool is very ingenious. Instead of depending upon a grinding action, the principle of chipping the concrete surface is employed. Mounted in a disk are twenty-four cutter wheels arranged in pairs, each wheel having from twenty-four to twenty-eight cutting teeth. As the disk revolves at high speed, the cutter wheels are made to roll over the concrete surface, each tooth acting as a tiny hammer to strike the concrete. The cutter wheels look like small spur gears, but instead of being radial, the teeth are eccentrically directed so that their edges are brought into contact absolutely square with the surface, and deal a direct blow to the material that is to be cut. The disk revolves at the rate of about 2,000 revolutions a minute, so that the number of blows per minute delivered by the cutter wheels runs up into the millions. The cutting tool is of such a form that it may be conveniently grasped and guided by the operator, and on it is a small switch by means of which the power may be readily turned on and off.

The average work per day of this tool is from seven to nine hundred square feet. The machine is ball-bearing throughout, and lubrication is so arranged that one grease cup at the junction of the motor and the flexible shaft supplies the entire tool with lubricant. There is an adjustment for the amount of cut which is provided by two front studs and two rear roller wheels. These may be adjusted independently so as to surface narrow projecting parts absolutely square without affecting the parallelism of the two rollers.

The machine may be used, as well, for surfacing stone and imitation stone, and for bringing out the aggregate in concrete, when that is desired.

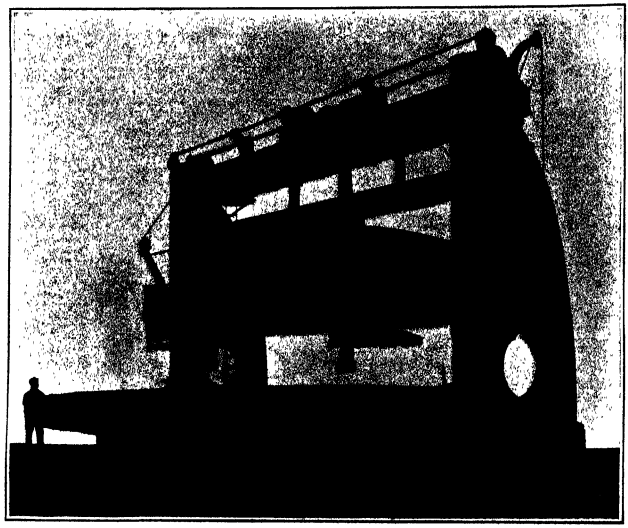
Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

A Record Breaking Boring Mill

THE machinery of war calls for the construction of enormous pieces with extreme accuracy. In order to machine the turret trucks of the big 14- and 16-inch guns of our navy a huge boring mill, the largest in America, has just been completed and delivered to the Brooklyn Navy Yard. It has a swing 36 feet in diameter with 12 feet under the tools. There is a type of boring mill, known as an extension mill in which the uprights may be moved back on an extension of the bed in order to admit larger pieces on the table. However, this is not an extension mill, but a regular cross-rail machine with fixed uprights and an actual swing of 36 feet 2 inches.

The table is 34 feet in diameter and will carry a weight of 200,000 pounds. The machine itself, including the motors which drive it, has a weight of 655,000 pounds or over 330 tons. The table is so big that it had to be cast in three parts, which altogether weigh 225,000 pounds. It runs on conical rollers which travel in a 24-foot track sunk in the bed. The table also rests on an adjustable bearing ring surrounding the central spindle. The latter is centered in the bed by an adjustable conical bush. The table is provided with a spur gear 28 feet in diameter, which is driven by two steel pinions placed on opposite sides.



Giant boring mill, with a swing of over thirty-six feet, for machining the turret tracks of our big battleships.

The uprights, as shown in one of our photographs, are huge box castings weighing 32,000 pounds each and rendered rigid by the steel girders connecting them. The cross-rail would stretch across two city lots. It is 46 feet long and weighs 85,000 pounds. Owing to its extreme length a camber beam is bolted to the top of it so as to stiffen it and take up the sag due to its great weight and that of the heads. To raise this enormous cross rail a 30 horse-power motor is provided. This is located on the top cross brace and operates four elevating screws working in bronze nuts.

The two boring and turning heads are provided with graduated swivels with worm gearing, to permit of setting them to any desired angle up to 30 degrees from the vertical. The traverse of the heads may be effected by hand or, when a rapid movement is desired, by a 10 horse-power motor mounted on the top brace. A platform is attached to each head, upon which the operator stands to control the traverse of the heads and their feed. The operating levers are interlocked so that the rapid traverse cannot be engaged for one head unless it is disengaged from the other, making it impossible for the operator on one head to move the opposite one accidentally.

The table is operated by a main driving motor of 75 horse-power, and variable speeds are provided for boring, turning and facing operations.

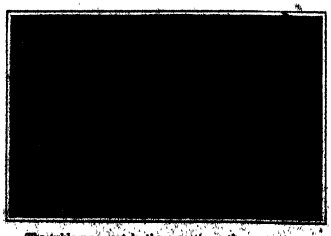
This machine will be used not only for finishing the tracks of the turrets, but also for boring cylinders and machining the casings of the large steam turbines of our war vessels.



The uprights are huge box castings weighing 32,000 pounds each.



A 70,000-pound section of the table.



The table was cast in three sections, the center one weighing 82,000 pounds.

Lectures in the Patent Office

OLD practitioners before the Patent Office recall the conferences which Commissioner Fisher held at frequent intervals with his office force, and in which he lectured the force not only on the administrative duties of the office, but on the fundamental law as related to the granting of patents by the Patent Office. Many important matters of practice were inaugurated during his administration of the office that have been continued to the present time. Commissioner Ewing has instituted the giving of lectures or addresses at intervals by members of his office force as well as some distinguished patent lawyers, doubtless in an effort to improve conditions and to standardize in a way the actions of the several divisions. Beginning with an address by the Commissioner himself on the administrative features of the Patent Office the lectures so far have included one by Mr. Willis M. Magruder, chief of the Assignment Division, on Assignments; one by Mr. Sewall, the chief of the Classification Division, on the Workings of His Department; an address by Examiner Loeffler, on Public Use; and one by Mr. Charles H. Pierce, one of Mr. Loeffler's assistant examiners, on Abandonment; and one by Frederick P. Fish, the distinguished Boston patent lawyer.

Mr. Fish directed his remarks mainly to a discussion of the question of patentability lamenting the absence of a uniform standard of patentability resulting from the different points of view and various mental attitudes of those passing upon the subject, not only in the Patent Office, but in the courts as well, and expressing the belief that a Court of Patent Appeals would do much to secure such uniformity of standard. In the course of his address Mr. Fish took occasion to pay a high tribute not only to the ability, but to the honesty, industry, and sincerity as well of the Patent Office force, and urged upon them the importance and propriety of their entertaining a friendly attitude toward the applicants even to the extent of suggesting patentable features in official actions, rather than permitting themselves to take any hostile stand.

Such advice is to be commended, as, if properly followed, the results would be most helpful in encouraging inventive progress, which is really the province of our patent system.

RECENTLY PATENTED INVENTIONS

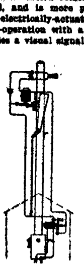
These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the Scientific American.

Pertaining to Apparel.

ADJUSTABLE NECKWEAR.—G. W. Coover, care of W. H. Browning, 15 Cooper Square, New York, N. Y. This invention primarily consists in the provision of a collar or neckband having an arrangement of buttonholes to permit the apparel to be properly adjusted to the neck of the wearer before and after the same has been laundered, thus providing against tightening of the neckband or collar, due to shrinking, and also against enlarging thereof, due to stretching.

Electrical Devices.

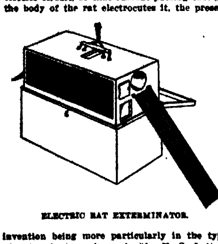
SIGNAL SYSTEM.—F. H. Wanstes, Marvell, Ark. This invention relates generally to a visual signal, and is more particularly directed to an electrically-actuated mechanism adapted for co-operation with a telephone circuit. It provides a visual signal, in connection



SIGNAL SYSTEM.

with a telephone circuit, whereby the central office may throw into exposed position a semaphore arm, or may light a lamp located at any suitable point, the signal-actuating mechanism being controlled by the calling current through the telephone.

ELECTRIC RAT EXTERMINATOR.—J. W. M. Carmichael, 331 Commerce St., Wellsburg, W. Va. This exterminator is of that type in which a rat is enticed into the device and in attempting to reach the bait is included in an electric circuit, so that current passing through the body of the rat electrocutes it, the present



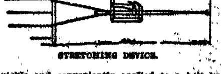
ELECTRIC RAT EXTERMINATOR.

invention being more particularly in the type of exterminators shown in the U. S. Letters Patent No. 1,084,976, formerly granted to Mr. Carmichael. The current used stuns the rats so that they will drop into a body of water and be drowned therein. A tray in the bottom of the tank is removable in water, to take out the entrapped and drowned rats.

FLASH LIGHT.—W. E. Compo, Toledo, Ohio. This inventor provides a light which may be used with the standard sized dry cells. He also provides a light which may be quickly and easily attached to or removed from a dry cell, and which may be adjusted when in place thereon in positions where flash or steady light may be obtained.

Of General Interest.

STRETCHING DEVICE.—E. O. Foulk, Pioneer, West Carroll Parish, La. This stretching means is more particularly adapted for embodiment in a belt stretcher, and also is useful for embodiment in a wire stretcher. The device when embodied in a belt stretcher may be



STRETCHING DEVICE.

quickly and conveniently applied to a belt by one man, and may be rapidly and conveniently operated to effect the desired stretching of the belt with a minimum loss of time. The invention also provides a stretching means possessing features that may be advantageously embodied in a simple form of wire stretcher.

RELEASE SAFETY HOOK.—W. Brown, A. C. R. Brown, and T. B. Murray, Adelaide, South Australia, Australia. This invention has been devised for use with boat davits, for securely holding and quickly releasing ships' boats, but it may be used in connection with general lifting and other purposes where hooks are required. It comprises two side members, a shackle, a spring, and a locking ring.

FASTENING.—D. W. Kolls, corner of 6th and Washington Sts., Portland, Ore. This invention provides a fastening more especially designed for fastening the posts or studs to lenses of eyeglasses and spectacles, and arranged to securely hold the lens in position on the post by the use of a screw holder out of contact with the lens.

SUCKER ROD PULLING DEVICE.—J. B. Dunlap and W. D. Bryan, Tulsa, Okla. This device is of use in lifting tubing, and the invention provides one having means for utilizing the ordinary pumping jack for lifting the sucker rods and tubing from oil wells and the like, thus dispensing with the necessity for a sucker rod pulling machine.

SEPARABLE EARTHEN INSULATING PIPE CIRCUIT.—W. B. Gray, Louisville, Ky. The object here is to provide a conduit having oppositely arranged pairs of longitudinal scores or cuts at each side, arranged to permit the upper half of the conduit to be easily and expeditiously separated from the lower half, to permit the insertion of the pipe.

PIPE SUPPORT.—W. B. Gray, Louisville, Ky. This invention provides a support adapted for supporting heating, steam pipes, and the like in earthen conduits, or other conduits, wherein a cradle is provided for engaging the conduit and a cradle for engaging the pipe, together with mechanism for connecting the saddle and the cradle to permit relative longitudinal movement of the saddle and cradle, and wherein other mechanism is provided for preventing relative vertical movement of the cradle and the saddle. Mr. Gray has also invented a pipe support for interposition between pipes such as heating pipes, and the insulating conduit within which the pipe is laid, for supporting the pipe so that it may move during expansion and contraction without danger of buckling or bending of the pipe or injury to the conduit, and wherein the arrangement is such that the parts always occupy a definite position with respect to each other, whatever the movement.

SEPARABLE INSULATING EARTHEN CONDUIT.—W. B. Gray, Louisville, Ky. This invention provides a conduit which may be, after baking, separated into upper and lower sections, to permit the lower section to be laid in the excavation and to receive the pipes to be supported, and afterward to permit the upper section to be placed and permanently connected to the lower section, and wherein the conduit is so constructed that a plurality of independent pipes may be supported in the conduit alongside one another, the supporting mechanisms for the several pipes being also independent.

DRIP RECEPTACLE FOR UMBRELLAS.—C. J. Madonna, 443 Seventh Ave., Brooklyn, N. Y. In order to accomplish the objects of this invention, use is made of a cup having an attaching hub adapted to engage the terminal of the umbrella stick to hold the drip receptacle in place, a collar for the passage of the said terminal and a tubular covering attached at its ends to the said cups and the said collar.

Hardware and Tools.

SCISSORS.—J. L. Bitz, 27 Perkins St., Coldwater, Mich. In the present invention the improvement has reference to scissors, and has for its object the provision of a pair of lever blades with inexpensive removable cutting members which may be conveniently replaced when those that have been in use become dull.

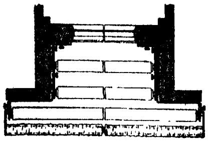
WEED DESTROYER.—C. O. Blandin, W. T. Davis, and W. A. Reynolds, 506 E. & C. Building, Denver, Colo. This destroyer is of the kind in which a liquid poison or other destructive liquid or material is applied to the roots of the weeds. The invention provides a device whereby a measured charge of the liquid is applied locally to the roots of the weeds, in order to destroy the weeds without danger to neighboring grass or other vegetation.

WRENCH.—L. W. Millsap, Jr., Woodland, Cal. This invention provides a wrench having an adjusting screw, whereby the wrench may be loosely adjusted upon a nut, and having a locking lever whereby after loose adjustment of the wrench the jaws thereof may be tightly forced against the nut, to prevent slipping of the wrench.

Household Utilities.

GREEN CORN SPOON.—A. Taubert, 631 E. 168th St., Bronx, N. Y., N. Y. This structure will readily remove the grains of corn without mashing the same. Another object of the invention is to provide an instrument in the nature of a spoon, which may be used for cutting the grains from an ear and either leaving the corn in place on the cob after being severed therefrom or placing the rows of grain on a receptacle.

WINDOW SHADE SUPPORT.—J. A. Reichtolo, Sigel, Ill. The purpose in this instance is to provide a structure which will present to view from the exterior and also from the interior the usual appearance of the ordinary shade and support, but will allow an adjustment whereby air may be allowed to pass into the room over the shade. A further object is to provide supporting brackets for a plurality of curtain rollers, and for a curtain or portière, which brackets are adapted to be secured

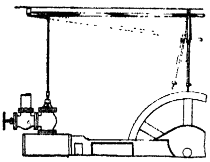


WINDOW SHADE SUPPORT

to the window sash and be moved thereby, thus allow a free open space above the shades and curtain when the sash is lowered.

Machines and Mechanical Devices.

AUTOMATIC ENGINE STOP.—T. Truran, Glacier, B. C., Canada. In the present patent the invention has reference to automatic engine stops, and the object is to provide a simple and effective arrangement by which to shut off an engine supply valve in connection with



AUTOMATIC ENGINE STOP

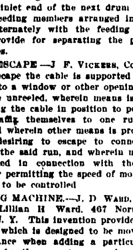
rope drives, and for actuation where the rope is broken and also where a splice pulls out or the rope slacks to such an extent that it might jump its proper groove and cause serious trouble.

CIGAR TUCK CUTTER.—G. W. Bowman, York, Pa. This invention relates to cigar cutters or trimmers of the type disclosed in Mr. Bowman's Patent No. 1,087,715. The general object of the present invention is the provision of a cutter of the type specified, with an automatic ejector for removing the cigars from a machine at the completion of the cutting operation.

MACHINE FOR REMOVING PULP FROM COCOA AND OTHER PULPY BERRIES.—J. M. Urgellés, care of J. Codina Morales, P. O. Box 897, Havana, Cuba. Use is made of a series of drums one above the other and having their inlet and exit ends arranged alternately on opposite sides of the machine, a feed hopper at the inlet end of the uppermost drum, chutes connecting the exit end of one drum with the inlet end of the next drum below, revoluble feeding members arranged in the said drums alternately with the feeding members. Means provide for separating the pulp from the berries.

FIRE ESCAPE.—J. F. Vickers, Colusa, Cal. In this escape the cable is supported on a reel adjacent to a window or other opening in position to be unreeled, wherein means is provided for holding the cable in position to permit persons to affix themselves to one run of the cable, and wherein other means is provided for persons desiring to escape to connect themselves to the said run, and wherein mechanism is provided in connection with the holding means for permitting the speed of movement of the cable to be controlled.

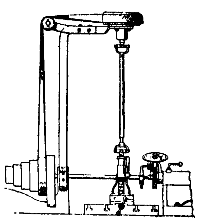
ADDING MACHINE.—J. D. Ward, deceased. Address Lillian H. Ward, 467 Normal Ave., Buffalo, N. Y. This invention provides a chain structure which is designed to be moved a certain distance when adding a particular number, whereby the operator can observe at all times the operation of the various parts and



ADDING MACHINE.

may know whether or not the movement of the chain is correct. It also provides an adding machine with chains formed with numbered tabs and co-acting means for raising the same so as to extend substantially normal to the chain in order to be grasped and operated by the operator.

GEAR CUTTING MECHANISM.—A. Fryeman, Souris, N. D. This invention relates to gear cutting machines, and more particularly to devices of this type which are used as lathe attachments for cutting gears and for seating keys. The invention is a lathe attachment comprising mechanism for holding a gear wheel



GEAR-CUTTING MACHINE

to be cut and for shifting the position of this gear wheel so as to properly space the teeth relatively to the position of the cutter, and also mechanism driven preferably from the lathe pulleys and including shafting provided with telescopic slides and universal joints for readily transmitting power to the gear cutter.

Railways and Their Accessories.

RAIL FITTING.—H. J. Bonham, Los Angeles, Cal. This improvement has for its purpose the provision of a simple, cheap means for smoothly and firmly connecting rails and pipes, which may be easily applied and removed, and which will firmly hold the rails and pipes in their proper relative position.

MONORAIL SYSTEM.—C. W. Putnam, Route 6, Mt. Carmel, Ill. This invention provides a rail support and balancing means for properly holding the car in position. It also provides a balancing arm structure connected to the car and associated with suitable braces along the track whereby the swaying of the car is controlled and the strain properly distributed.

Pertaining to Recreation.

FIGURE TOY.—J. W. Murray, St. George, New Brunswick, Canada. This invention relates to toys and has particular reference to devices in which certain figures, such as, for instance, figures of ferocious animals are employed. Among the special objects of this in-

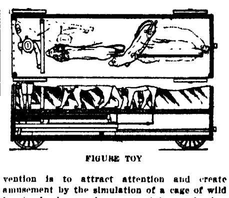


FIGURE TOY

vention is to attract attention and create amusement by the simulation of a cage of wild beasts having a keeper, certain mechanism being employed whereby the animals and the keeper will be given certain movements.

Pertaining to Vehicles.

STEERING DEVICE FOR AUTOMOBILES.—J. R. Junkin, Fairview Hotel, Fairbanks, Alaska. This invention relates to steering devices of motor vehicles, and more particularly to those in which the actual turning of the wheels is accomplished through power derived from the motor, under control of the usual steering shaft or post, the invention being particularly adapted for use in connection with heavy machines, either pleasure or commercial vehicles.

Note.—Copies of any of these patents will be furnished by the Scientific American for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Laying the Aqueduct Siphon Across the Narrows to Staten Island

(Continued from page 305.)

the spigot of the next section. One of our photographs shows the first three sections of the pipe being laid. These had to be dragged down the skidway and hauled through a bulkhead to connect with the land end of the pipe line.

At the present writing, the pipe laying has not proceeded far enough to permit the lighter to be moved over the skidway in the position shown in our front page illustration. Instead of that, the cradle is secured to the side of the lighter, as shown in the photograph. As the pipe line runs down an incline from the shore until it reaches the requisite depth, the panels at the after end of the skidway are uncoupled so that they may conform to the grade of the trench.

Before the plan was completed for laying the siphon, extensive experiments were made to determine a safe depth at which the pipe line could be buried to bring it out of reach of heavy ships' anchors. To this end, anchors of various forms were dragged along the bottom of the harbor and their penetration was noted. As a result of these experiments it was decided to provide a cover of at least 8 feet over the siphon, and as the War Department requires a clear depth of 45 feet, this made it necessary to keep the upper wall of the pipe line at least 53 feet below the mean sea level. This calls for a great deal of excavation in some places. The dredge may not operate more than a thousand feet ahead of the pipe-laying lighter, lest the excavation fill with silt, under action of the tide.

There are about eight hundred pipe sections to be laid. At present about four sections are laid per day. The work may take the greater part of a year. During the winter operations may be suspended, owing to the difficulty of working in such an exposed location. The end of the pipe line will then be closed and dropped to the bottom. In the spring, when milder weather prevails, the end of the siphon will be picked up and hauled upon the launching cradle and the pipe laying will be resumed.

A Final (?) Word on the Benzoate of Sodium Controversy

THREE years ago, when Dr. Wiley's partisans were still inveighing against the findings of the Referee Board regarding the alleged poisonous action of sodium benzoate when used as a preservative of jams and meats, they claimed to derive much comfort from the results of a German investigation of the subject. The German government, having become interested in the American dispute, had requested a board of experts to give an opinion on the use of benzoic acid and its salts in the preservation of food. This commission criticised the findings of the Referee Board on the ground that its experiments with large doses of benzoates were of too short duration, and conjectured that ill results might follow the long-continued administration of the preservative in very large doses. It also advised against the use of benzoates in food on the theoretical ground that, though they were evidently innocuous in small doses, one might eat and drink in the course of the day so many things containing them that a sufficient quantity might be taken to be injurious. The commission stated, however, that one-half gram (7½ grains) of benzoic acid or its salts consumed in divided doses throughout the day, must be regarded as harmless to the human body. This was sufficiently corroborative of the findings of the American Referee Board to convince any unprejudiced observer that the United States Government was justified, on the strength of this board's report, in permitting the use of benzoates as a preservative, provided the fact of such use was stated on the package. Some more recent experiments made by Drs. Rost, Franz, and Weitnel of the German Imperial Board of Health (Arbeiten aus dem Kaiserlichen Gesundheitsamte, xiv, 428) have confirmed the previous findings as to the innocuousness

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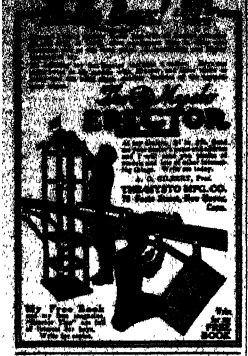
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of which dogs were examined. Throughout a long course and have shown that the figure ascertained by the previous experimenters were presumptuous. They found that dogs could take daily doses of one gram per kilogram of weight of the animals for weeks and months without showing any toxic effects. This is the equivalent of over an ounce and a half per day for a man of 110 pounds, or 80 kilos, weight—a dose which could not possibly be taken in any amount of jam or other preserves that could be eaten in twenty-four hours. Rabbits could take even larger doses, from 1.5 to 2.4 grams per kilo of animal weight, the equivalent of about two to four ounces for a small man. This ought to dispose of the question finally, but probably will not, for those who were misled by the spectacular but not altogether scientific experiments of Dr. Wiley with his "poison squad" will never acknowledge themselves convicted of error by the German Imperial Board of Health after they have rejected the testimony of such men as Remsen, Chittenden, Herter, and Long, who composed the American Referee Board.—*Medical Record.*

Foreign Students at American Colleges and Universities

THERE were 4,222 foreign students in attendance at colleges and universities in the United States in the year 1913, according to figures just compiled at the United States Bureau of Education, and reviewed in *Science*. This is an increase of 577 in two years. These students are not concentrated at the larger and better known institutions, as might be expected, but are distributed over 275 different colleges, universities and schools of technology. The number given includes only regular students of college or graduate grade; if students enrolled in preparatory departments, short-term courses, summer schools and independent professional schools were included, the total would be very much larger.

Canada has the largest representation—653 students. China and Japan are not far behind—there were 594 Chinese students and 336 from Japan attending colleges in the United States in 1913. Of the other Oriental or Asiatic peoples, India is represented by 102 students; Turkey by 143; Korea by 13; Persia by 21, and Siam by 13.

Latin-America is strongly represented. Cuba sends 209; Costa Rica, 29; Guatemala, 15; Honduras, 12; Nicaragua, 18; Panama, 28, and Salvador, 19. Mexico heads the list with 223 students. From South America, Argentine sends 43 students; Brazil, 113; Bolivia, 3; Chile, 12; Colombia, 37; Ecuador, 16; Paraguay, 2; Peru, 25; Uruguay, 2, and Venezuela, 7.

Abundance of higher educational opportunities in the British Isles and on the continent of Europe has not prevented nearly 800 European students from coming to America to go to college. Great Britain and Ireland are represented by 212 students, and Germany, herself the Mecca of the studious, sends 122. The others, in order of numbers, are: Russia, 124; France, 45; Sweden, 41; Italy, 38; Austria-Hungary, 34; Switzerland, 29; Norway, 26; Greece, 22; Spain, 20; Netherlands, 19; Bulgaria, 15; Roumania, 6; Belgium, 4; Portugal, 3; Montenegro, 1.

Even Australia and Africa have students at colleges in the United States. There are 66 students from New Zealand. Africa is represented by 15 from Egypt; 2 from Liberia, and 44 from South Africa.

From American possessions 434 students came to college in the United States; 108 from Hawaii; 215 from Porto Rico, and 111 from the Philippine Islands.

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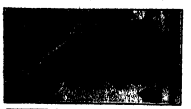
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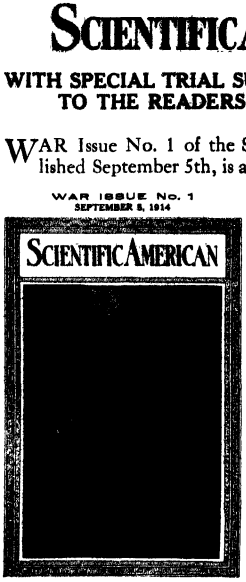
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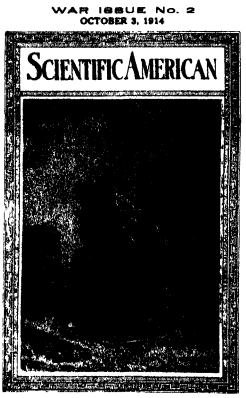
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WAR ISSUE No. 1
SEPTEMBER 5, 1914



WAR ISSUE No. 2
OCTOBER 3, 1914



The comparative size and strength of the Navies of the Triple Entente and the Dual Alliance—illustrations of all the types of battleships, cruisers, torpedo boats, etc., of each Navy, together with a description of their guns, calibre, weight, velocity, etc.—aeroplanes and dirigibles of each nation. Illustrated by 110 photographs and War Map in four colors.

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NEW BOOKS, ETC.

DIE TECHNIK DES ALTERTUMS. Ein Handbuch über Archäologie und Geschichte der Kultur und der Naturwissenschaften, Kunsthandwerker, und Antiquare. Von Franz Feldhaus. Mit 573 Abbildungen. Leipzig und Berlin: Verlag von Wilhelm Engelmann, 1914.

This volume may be regarded as a very useful reference book on the history of technology, in dictionary form. The author does not present it as an exhaustive inquiry into every branch of technics, but rather as a means of assisting those who take an academic interest in certain phases of technology. Mr. Feldhaus has for years patiently gathered an immense amount of material on the history of science and engineering. He has frequently contributed to technical and popular periodicals very valuable and instructive articles on the evolution of machines and processes. He is probably the best-informed man in Germany on the historical aspects of science and engineering, and therefore peculiarly competent to undertake the preparation of such an ambitious work as this. Although compiled in dictionary form, Mr. Feldhaus's book is really an admirable history of technology, and not simply a history of some well-known arts. The dates have all been so carefully checked up that museums, in particular, will find Mr. Feldhaus's book very useful. It has been rather difficult in the past to make any positive assertions as to the introduction of an invention or process, because very few technically informed men have taken the trouble to interest themselves historically in their own profession. Particularly interesting and valuable are the illustrations, which have been lavishly incorporated. They are, all of them, of immense historical value, and all of them selected for their technical fitness. Indeed, the illustrations alone represent in their gathering an immense amount of labor, for which the antiquarian ought to be truly grateful. Mr. Feldhaus has prepared in brief an extremely valuable reference book, which contains an enormous amount of information not to be found in the regular cyclopedias and which should be extremely useful to the special student

SLIDE-RULE NOTES. By Col. H. C. Dunlop and C. S. Jackson, M.A. New York: Longmans, Green & Co., 1913. Crown 8vo.; 127 pp.; with diagrams. Price, 75 cents net.

Students and users of that ingenious little device, the slide rule, will find in this monograph, based upon a work of the same title now out of print, full and clear information of the various uses to which the instrument lends itself. The material of the earlier work has been revised, rewritten, and added to, and there is an entirely new section dealing with the logologarithmic scales. Mannheim's 25-centimeter rule is the type almost exclusively dealt with. Hence the work serves as an introduction to the more elaborate types.

THE OFFICIAL GOOD ROADS YEAR BOOK OF THE UNITED STATES. Washington, D. C.: American Highway Association. 8vo.; 501 pp.

A brief history of road building, the systems of foreign countries, and legislative development are presented in the early pages of the volume. Types of roads, dust prevention, and maintenance and repair receive considerable attention, while a large portion of the work is given over to lists of highway officials, patents pertaining to roads, bulletins and circulars on the subject, and the existing associations of the various states

BUSINESS ADMINISTRATION. Its Models in War, Statecraft and Science. By Edw. D. Jones. New York: The Engineering Magazine Company, 1914. 16mo.; 275 pp.

This is a volume in the "Works Management Library," and gives a history of the development of a new profession. The author deals with the administrator as general, the administrator as scientist and the administrator as diplomat. The book is an extremely interesting one to any modern business man who is at all interested in efficiency. The arguments of the author are as follows. First, that success in dealing with men and rules depends upon certain basic propositions and laws which can be discovered by studying the work of successful administrators. Second, that the rules and methods followed by masters of business and finance are usually deliberately hidden, and there are no records throwing clear, full light on their lives and acts. Third, that leaders in statecraft, war and science, on the contrary, are figures of world interest whose careers and practice are illuminated fully and searchingly by public and private records, correspondence, personal reminiscences, and even petty pundits. From such data Prof. Jones has analyzed definite primary principles of administration. In history and the biographies of military conquerors, diplomats and scientists he finds the elementary rules of success.

THE MANUAL OF STATISTICS. Stock Exchange Hand-Book, 1914. Thirty-sixth Annual Edition. New York: The Manual of Statistics Company, 1914. 12mo.; 1,110 pp. Price, $5.

"The Manual of Statistics" brings together the best aggregation of facts, which makes it of great value. It is a work of reference, not only for the broker and banker, but for the businessman as well. It solves up the question of railroad securities, industrial securities, mining, etc. It is the recognized standard in the financial world, and at least one copy should find a place in every office.

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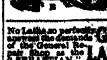
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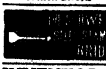
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Some of the "Whys" of the Eight-Cylinder Cadillac

The superior steadiness of the Eight-Cylinder Cadillac has its source in several causes, each and every one of them scientifically exact.

This superlative smoothness, in other words, is not left to chance, but is the positive result of positive principles.

And these positive principles exert secondary influences, each of which, in turn, contributes to the same desired end.

Translated into the simplest language, eight cylinders mean greater continuity in the generation of power. The greater the degree of continuity, the greater the smoothness, and the less the vibration, of course.

This, then, is the main and primary source of that steadiness which makes you forget that an engine is at work carrying the car forward.

The power impulses are not "almost" continuous, but actually and completely continuous, so that you are assured that the riding qualities of the car are as scientifically smooth as they can practically be made.

And then there are added to the main principle, the supplementary advantages which accrue from the very nature of the V-type engine—every one of them tending, again, to lessen vibration.

The crankshaft in the Cadillac V-type eight-cylinder engine, for instance, is but $26\frac{1}{16}$ inches long, between the outer ends of its rear and forward bearings.

Experienced motorists, familiar with the periodic vibration or "thrashing" which is characteristic in engines requiring a long crankshaft, will recognize immediately the beneficial effect of the lesser length.

The cam shaft, which is driven by a silent chain from the crankshaft is likewise shorter, and another tendency toward periodic vibration is thus removed.

All of the reciprocating parts, including pistons, connecting rods, valves, etc., are very much lighter, a fact which in itself contributes very largely to smoothness and absence of vibration.

Again, the "smashing" force with which the power impulses are ordinarily applied, is eliminated in this Cadillac Eight-Cylinder engine because the application of power is distributed over eight pistons—an impulse every quarter turn of the fly-wheel—another element contributing to smoothness.

The impulses overlap so completely that they melt and merge, as we have said before, one into another. When one power impulse is but half way on its stroke, another impulse begins and the impact on each is relatively light.

No severe shock or jar is communicated in these explosions. The process is not a succession of hammering blows, but rather like the touch of light and expert fingers sweeping the keyboard of a piano with almost incredible speed.

The net result is that unique sensation which tends to make you forget the presence of the engine—that sense of buoyance and of being borne forward by some means other than mechanical.

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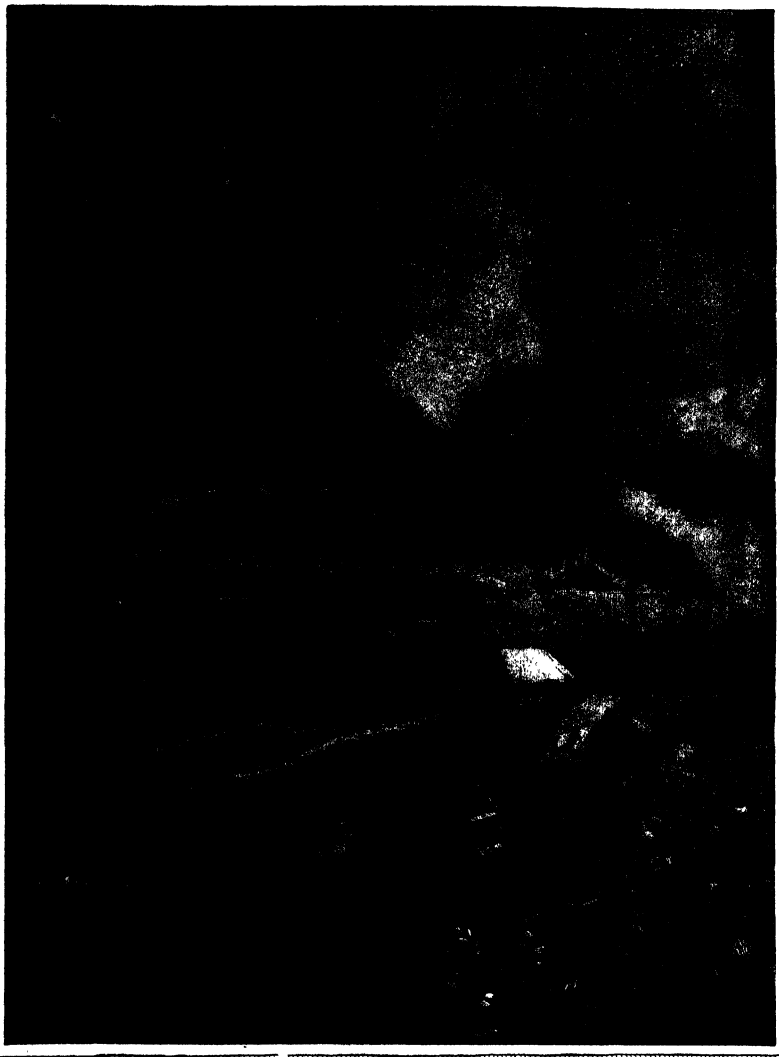
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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement

Technical Fallacies of the Present War

THE daily press is complaining of the severe censorship exercised over news from the seat of war; nevertheless, it would be better, in some respects, for the public if the censor's blue pencil were used even more freely than it is.

We refer to the sensational and misleading technical absurdities which from time to time are passed by the censor and permitted to go broadcast over the world for the confusion and bewilderment of the public, which is weary of rumors and asks only for the facts. If it is the duty of the censor to eliminate any statement which might be of value to the enemy, surely it is his duty, also, to cut out of the dispatches exaggerated statements as to the nature and destructive effect of the weapons which are employed by the combatants. If these exaggerations could have any beneficial effect, in misleading the enemy by causing him to modify his strategy or tactics, the censor would be following a precedent which has been employed from time immemorial in the conduct of war, but no such result is secured and it is only the unsuspecting public that suffers.

The military censor knows perfectly well that all the statements which have been going the round of the press regarding *mobile* 16-inch guns used by the Germans, shrapnel which will annihilate a whole regiment with a single burst of one shell, high explosive shells whose death dealing gases kill a company of infantrymen without leaving a mark upon their bodies, he knows full well, we say, that most, if not all, of this talk is the veriest kind of rubbish.

That these absurdities are too often received at their face value is proved by the number of inquiries which come to this office, asking for further details respecting these appalling weapons of modern warfare.

In the first place, then let it be understood that the 16 inch German *mobile* siege gun does not exist and probably never will exist. It is possible that some siege guns of this caliber have been built for fixed fortifications, but certainly never as mobile siege guns to be carried with an army in the field. The largest field siege gun is the huge 11 inch howitzer or mortar which is shown in action on the front cover of the SCIENTIFIC AMERICAN of October 3rd, 1914, and is further illustrated and described on page 296 of that issue. It was a great feat on the part of the Krupp firm to produce a gun of this size, weight and power, that could be transported with an army over the highways of a hostile country, and go into action on its own mount, without preliminary foundation work for the reduction of fortifications from five to seven miles distant. Broadly speaking, the weights both of a gun and its ammunition increase as the cube of the caliber. This means that a mobile 16 inch siege gun complete would weigh something over 100 tons and its shell would be approximately one ton in weight. The finest macadam, brick or concrete roadway would be crushed down under such a load, even supposing that traction engines of sufficient power and number could be linked up to transport it. It may have been done, but we doubt it.

Another fallacy is that of the wholesale annihilation of troops caused by bursting shrapnel. More than once we have been asked to explain what kind of a shell it is which, in bursting discharges a shower of bullets "which will kill every man within a rectangle seventy yards square." The answer is that no such shell has been invented, and never will be. On page 261 of our second War Issue, of October 3rd, the action of shrapnel is illustrated and explained in the article by Lieut.-Col. Leon S. Roudiez, adjutant general of the United States Army. The shrapnel shell contains 262 balls which, when the shell bursts in the proper position above the enemy's troops, will cover an area of ground elliptical in form. The area is, roughly, about 45,000 square feet. Now anyone can calculate for himself that, if the dispersion is fairly even, there will be an average of one ball to each 120 square feet of space covered, or say, one ball to each square measuring about eleven feet on a side. If the troops under fire are in a trench, with only head and shoulders exposed, and with, say, three feet interval between the men, it will be seen that the chances of a bullet finding its man are one in one hundred for each bursting shell.

Even more ridiculous are the stories about the killing of groups of men by the shock and the poisonous gases of exploding shells. More than once, in describing the trenches or city streets after a battle, or houses that had been under shell-fire, correspondents have spoken of the dead being found without a single scratch upon their bodies and preserving exactly the attitude in which they stood or sat, when this mysterious engine of destruction smote them. The shock of exploding shell may produce deafness and temporary unconsciousness; but if the explosions take place near enough to produce death, the men affected will be hurled by the blast in every direction.

Then there is the subject of bomb-dropping from aeroplanes and dirigibles, regarding whose military value as a means of reducing fortifications or even of destroying cities there is in the public mind a greatly exaggerated estimate.

We do not hesitate to say that one of the German 11-inch siege guns, aided by range-finders and observers at the end of a measured base line, would place more shells within a fort in a single hour than the whole fleet of German dirigibles could do in an all-day attack.

The Problem of Our Merchant Marine

AN American-built merchant steamer costs more per ton to construct and equip than a ship of the same size and class built in the yards of our foreign competitors; furthermore, when the ship goes into service, the cost of American operation is greatly in excess of the cost of operation in the foreign merchant service. Burdened with these disadvantages, the American deep-sea carrying trade has not proved attractive to American capital, and the tonnage of American deep-sea shipping has dwindled to an insignificant amount.

With a view to removing the first disability, that of high first cost, Congress has recently passed a law which makes possible the purchase of foreign-built ships for operation under the American flag; but, unfortunately for the solution of the problem, the greater first cost of an American-built ship is not nearly so serious a handicap as the very much greater cost of her operation. Hence, although under the new law thirty-six foreign-built vessels of 135,986 gross tons have already been registered for foreign commerce, it is realized by all who have made an intelligent study of the problem, that something more remains to be done, if we are to enter the deep-sea trade with any hope of obtaining a merchant marine of a size commensurate with our wealth and commercial standing.

We commend to the serious study of the public a series of three articles on our merchant marine which have been contributed to our columns by Winthrop L. Marvin, the last of which appears in the present issue. The question of how to restore our merchant marine to its former position of supremacy is many-sided and difficult, and the issue is greatly complicated by the fact that in Congress it has been beclouded by political considerations and the tendency of Congressmen to regard the subject from a local rather than from a broad national point of view. Mr. Marvin's study of the question is clear, forceful, and very convincing.

In the first of his articles, published in our issue of October 3rd, Mr. Marvin reviewed the history of our merchant marine, and showed that although there were several contributory influences tending to bring about its decline, the fundamental cause was the passing by Congress in 1828 of the so-called reciprocity act which opened the carrying trades from other countries to the ships of Great Britain and our other European competitors. The proportion of American commerce conveyed in American ships began almost immediately to decrease, and it has been falling ever since, until to-day it has all but reached the point of extinction.

It is pointed out in the current article by Mr. Marvin, that the majority of the thirty-six ships which have been brought under the American flag by the passage of the act on August 18th, 1914, were foreign-built vessels which were already registered for foreign commerce, and that the foreign officers of some of the naturalized vessels have promptly claimed and received the wage rate of American officers. Thus the cost of the British engine room force of one steamer of the United States Steel Corporation was thereby increased from $282 to $420 a month. That the probable failure of the free registry law to fully meet the needs of the case is recognized in Congress is shown by the fact that a bill which receives strong Government support is up in Congress, for Government control and operation of steamship companies in which private investors shall be allowed to have a minority interest. This, however, we cannot but regard as an expedient of very doubtful value.

Mr. Marvin concludes that the maritime conditions now confronting the American people are strikingly like those which faced Washington, Jefferson, and Madison in 1789. They met the crisis in a series of enactments which gave preference in employment to American ships in the carrying of American commerce. Of the two ways (rebates or subsidies) of renewing these conditions, one or the other would seem to be absolutely necessary; this for the reason that our foreign competitors are so largely subsidized. We are of the opinion that the more preferable would be the adoption of a system of preferential duties, under which there would be a percentage rebate of custom duties upon all freight brought to ports of the United States in American bottoms.

There is every reason to believe that a nationally protected merchant marine would to-day exhibit a growth in numbers and tonnage commensurate with that which it enjoyed in the early days of the country.

A Dearth of Foreign Scientific Journals

WHILE the precise effects of the present European conflict upon America's supply of meats, groceries, and the like has been a matter of such uncertainty as to call for Government investigation, the abrupt curtailment of mental pabulum in the shape of scientific literature from the countries engaged in the struggle has been only too evident. The librarian of a large scientific library informs us that not a scrap of literature of a date later than August 1st has come to hand from Germany, and only a solitary scientific journal, viz., the *Oesterreichische Ptag-Zeitschrift* of August 10th, from Austria. The Austrian publication opens with the announcement that many of its staff have been called to the colors, and craves the indulgence of its readers for the results of this untoward situation upon the contents of the journal and for possible future delays in publication. Several French scientific periodicals have continued to arrive with little or no delay; others, including the well-known popular weekly *La Nature*, have been definitely suspended until the war is over. The *Comptes Rendus* of the French Academy of Sciences has, in accordance with its official character, been strongly colored with expressions of patriotism since the war began. The number corresponding to the session of August 3rd contains a declaration by the president of the Academy that all academicians not already mobilized in the public service hold themselves ready to aid the national defense according to their several specialties. The number of August 10th pays tribute to the Belgian nation and army, and contains a memoir addressed to French military surgeons giving practical advice as to the treatment of wounds. The English journals are still arriving regularly.

The Agricultural Advisers of the French Government

THE recent reorganization of the Superior Council of Agriculture (*Conseil supérieur de l'Agriculture*) of the French government calls attention to an interesting official body having no equivalent in the government of the United States. Established in 1882, it was reorganized by a decree of March 4th, 1903, and again by a decree of July 15th, 1913.

It is the duty of this council to give advice on all questions proposed by the Ministry of Agriculture, particularly in connection with agricultural legislation, measures for the encouragement of agricultural production, questions of agricultural sociology, political economy, duties and tariffs. In its new form the council includes three classes of members; namely, *ex officio* members, elected members, and members nominated by ministerial decree. The *ex officio* members comprise the president of the agricultural committees of the Senate and the Chamber of Deputies, and the chiefs of the various divisions of the Ministry of Agriculture. The French Academy of Sciences and the agricultural associations are each represented by one elected member, as are also the twelve external services connected with the Ministry of Agriculture. Lastly, the Minister of Agriculture nominates 60 members, chosen for their distinguished work in pure or applied agricultural science, and 25 members distinguished in economic and social matters. All members are chosen for three years, and are re-eligible indefinitely.

Engineering

The Taxi Competes with the Rickshaw.—Engineering has even invaded the field of the rickshaw coolie in Ceylon. A taxicab service with 20 automobiles of American make is to be put into immediate operation in Colombo. The fares are made low with the idea of successfully competing with the rickshaw.

Italian Navy Seeks American Steel.—A report from Rome states that owing to all steel material for ships under construction for the Italian Navy being tied up in France and Germany, the United States is looked to for the needed material, and American steel plants have been approached with a view of securing the large tonnage required.

Economy of Oil-fired Locomotives.—Trials of Argentine petroleum in one of the locomotives of the Port of Buenos Aires in the last two months have so well satisfied the authorities that it has been decided to use it in all the locomotives of the port. The test was made with Comodoro Rividavia petroleum in a 250 h.p. locomotive where it showed economy over coal of 20 to 30 per cent.

Fluorspar Production.—Fluorspar production in the United States in 1913 aggregated 115,580 tons, the average price being $6.37. Imports were 22,682 tons which averaged $3.15 in price. About 80 per cent. of the domestic and all of the imported was consumed as a flux in basic open-hearth steel furnaces. The small remainder was used as a flux by silver, copper, and lead smelters; in the manufacture of fluorides of iron and manganese for steel fluxing; in the manufacture of glass and enamelled ware; in the production of aluminum; electrolitic refining of antimony and lead, etc.

Important Railroad Construction in the Caucasus.—A concession has been granted to a Russian Prince and associates for the construction of a railroad in the Caucasus to connect the celebrated resort, Borjum, with Kars, which will be 233 miles long and cost approximately $32,000,000. Application has also been made for permission to form a company to build another road 129 miles long to cost about $7,000,000 which will extend from Adiat, on the trans-Caucasian Railroad, to Astara and complete a chain of railroads connecting northern Persia with the industrial cities of central Russia.

American Mining in Korea.—Nearly all the important gold mines of Chosen are concessions given to foreigners by the former Korean Government. Most of these are in the hands of Americans. Prior to the annexation in 1912 the annual output of precious metals was about $2,500,000. It is now valued at about $4,500,000. The most prosperous mines are at Unsan. They are managed by an American Company and employ about 70 officials and 2,000 miners and laborers. There are also deposits of anthracite, iron, graphite and copper but the major portion of present results come from the gold mines.

Harbor Improvements for Formosa.—One of the most important public works now being carried on by the Taiwan Government is the improvement of the harbor at its principal port, Keelung, at the extreme northern end of the island, through which passes more than half of the shipping. The new work includes large warehouses of steel and of reinforced concrete, a sea wall, for protection against the destructive typhoons, is to be lengthened some 14,000 feet, twenty-one mooring buoys are to be placed, and eight cranes of 1½ and 10 tons are to be added to the equipment. Improvements of the same general nature are also being carried on at Takao, Tansing and Tansui.

Blasting with Liquid Oxygen.—It has long been known that liquid oxygen mixed with substances like cotton wool forms a powerful explosive, but serious difficulties were encountered in its practical use. A new method has now been discovered for handling this oxygen that makes it practical for commercial use. Bags are filled with a special form of lamp black, which are soaked in the liquid oxygen for a few minutes just before they are required for use. If the bag is now lighted with a match it will burn quietly and very slowly, but if detonated it explodes with the force of dynamite, and the cost is much less. Much less carbon monoxide is given off than by most other explosives, and there is no danger from a misfire as the oxygen will evaporate in a short time.

A Hundred Foot Standard for Chicago.—The Western Society of Engineers has had prepared a 100 foot length standard which it has presented to the city of Chicago. This standard is a steel rod 102 feet 10ng, two inches wide and half an inch in thickness, which rests on rollers secured to substantial brackets fixed to the wall. The graduations, which were established by Prof. L. A. Fischer of the U. S. Bureau of Standards, Washington, D. C., were at zero, 1 foot, 1 yard, 1 meter 10 feet, 25 feet, 50 feet, 66 feet, 20 meters, 30 meters and 100 feet, and at each of these points a disc of an alloy of 90 per cent platinum and 10 per cent. iridium 5.16 inch in diameter was inserted in the rod flush with its surface, the exact division point being marked on the disc. The work of graduation proved remarkably accurate, as is shown by the correction table furnished for use in connection with comparisons of measures.

Science

The Effect of the War on Our Universities.—An interesting criterion on the effect of the European war on our universities is afforded in a statement given out recently from the Chemistry Department at Columbia University. According to that department, a list of students who prior to the war had planned to go to Germany to study are now seeking information as to the courses afforded at home, and it is estimated that when the university opens, the registration at Columbia in all of its departments will be materially increased through the students who cannot pursue their studies abroad. One of the courses which is especially attracting those who had contemplated a winter at the German institutions is that afforded in Industrial Chemistry. The reason for this furnishes another illustration of how much Germany is sacrificing, educationally as well as economically, in the present war. She stood foremost in the production of chemical industries, and her universities offered courses in industrial chemistry which were the model of the world.

Isomorphism.—The phenomenon of isomorphism, or identity of crystal form, is very interesting and at the same time easily demonstrated by simple experiments. For instance, when a crystal of chrome alum is suspended in a saturated solution of potassium alum, we get a crystal having a violet center and a clear white overgrowth. This experiment may be repeated using any of the alums or vitriols having the same relative composition. A few examples of isomorphous substances are given below which were chosen on account of their colors:

Nickel sulfate	green
Magnesium sulfate	white
Potassium sulfate	yellow
Potassium chromate	white
Ferrous sulfate	green
Magnesium, Zinc	white

Isomorphism has found a practical use through its aid in the determination of the atomic weights, for, as will be noticed, isomorphous substances always have the same number of atoms to the molecule. Thus the formulæ for nickel sulfate and magnesium sulfate are $MgSO_4$ and $NiSO_4$, respectively, each having six atoms to the molecule.

The Australasian Antarctic Expedition, 1911-1914.—*The Geographical Journal* for September contains the first comprehensive and connected account of this remarkably fruitful expedition that has yet appeared in print; viz., the full text of the lecture delivered by Sir Douglas Mawson before the Royal Geographical Society, June 9th, 1914. It is accompanied by excellent photographs and charts. The lecture clears up two points that have been obscure and mysterious in the previous news of the expedition: (1) The name "King George V Land" has been given by Mawson, not to the whole coast explored by his expedition (the "Wilkes Land" of most geographers), as shown on the chart published in *Nature* of March 5th, 1914, but to a relatively small region at the eastern end of this coast and just east of Adélie Land. (2) The curiously bungled dispatch published in American newspapers in August, 1913, according to which a New Zealand government steamer had relieved Mawson and his marooned companions in the dead of the Antarctic winter, and had found them on the verge of starvation, really referred to a journey made by the steamer "Tutanekai" to Macquarie Island, to carry aid to the small section of Mawson's expedition left there to maintain a wireless station. Mawson himself was in Adélie Land at the time, and of course inaccessible.

Publications of the Bureau of Standards.—The U. S. Bureau of Standards published last year, as Circular No. 24, a list and detailed analysis of the scientific, technological and miscellaneous reports, papers, etc., issued since its work began in 1901, the total number amounting to about 300. A supplement has recently been published, bringing the list down to date. Most of the scientific papers issued by the Bureau are published originally in its Bulletin, which is now in its tenth volume, and are then reissued separately. The complete Bulletin is furnished free to educational and scientific institutions, while the reprints of separate papers are furnished free to individual applicants. There is a separate series of technologic papers, begun in 1911, and a series of Bureau circulars. The whole literary output testifies to the remarkably varied and extensive researches which have been carried on by this official institution in connection with the task of establishing and maintaining the various standards and units of measurement, the development of measuring instruments and methods, and the determination of physical constants and the properties of materials. The Bureau is constantly making important contributions to the world's knowledge of electricity, photometry, heat, optics, chemistry, etc., and probably approaches more nearly the ideal of a research institution than any establishment of the United States Government.

Automobile

A New Starter for Explosive Engines.—D. Maurice Hartsough, of Minneapolis, Minn., in a patent, No. 1,105,775, utilizes in explosive engines for starting purposes a portion of the gas compressed in one or more of the engine cylinders, stores the gas in a reservoir, and introduces it into the engine cylinder or cylinders to start the engine.

One Result of Standardization.—The results which follow the introduction of standardization of automobile parts, and, above all, a standardization of their method of manufacture, may not always be as readily appreciable as in the case with one Syracuse manufacturer who has been able to reduce the manufacturing cost per car by as much as $600. The Taylor system of scientific works management was begun in 1908, but not perfected until four years later.

Increasing Mileage of Electrics. The recent performance of an electric automobile is interesting, and calls to mind the days of not so long ago when to obtain as much as 100 miles on a single battery charge was considered quite out of the ordinary. The car to which we refer was owned and driven by a private owner. He drove from Philadelphia to Atlantic City and return without having his battery either charged or boosted on the journey. The distance by road is 140 miles and the car averaged 15 miles an hour. The battery used was a regular stock battery of the lead-acid type.

Room for Magneto Simplification. Although the modern automobile has been marvelously simplified in the past few years, comparatively little attention has been paid to the ignition system. True, the present high tension magneto and jump spark are infinitely simpler at least in operation—than the older low tension system, with its eternally leaking make and break mechanism. But still there appears room for simplification of the high tension magneto. Why cannot the make and break parts for instance be made lighter and perhaps of a type so that the hammering of the parts due to their weight will be decreased?

Steel Cylinders Economically Made.—Although the use of steel cylinders is fairly common in aeronautical work, this construction has not yet become very common for motorcars, due probably to the high cost. Latterly, however, a Berlin firm has succeeded in producing steel cylinder motors which cost but little more than the old cast iron type. The principal advantages of the steel cylinders are: First, their light weight which is one-third lighter than the lightest cast iron cylinder, second, their clean appearance, third, the possibility of better cooling due to the thin metal, fourth, increased thermal efficiency because higher compression is possible with better cooling, fifth, accuracy of manufacture.

New Primary Battery Cell.—A new primary battery cell, the invention of Dr. E. Bellini, which gives promise has made its appearance on the foreign market. Plates of lead amalgam, obtained by pouring 10 grammes of mercury into 90 grammes of molten lead, form the negative elements. The positive element is carbon, and the two are immersed in a solution of 80 parts sulphuric acid, 120 parts of nitric acid and 1,000 parts distilled water. One battery consisting of four positive plates and three negatives, the plate surface being 900 square centimeters, had an internal resistance of 0.022 ohms at 5 amperes discharge. The capacity was 112.5 ampere hours, after which the electrolyte required additions of acid.

Palpable Piston Ring Fault. The almost universally used concentric, split piston ring does not give the satisfaction that is expected of devices of the kind by modern automobile engineers, and it is interesting to note that latterly rings of other types are coming in for a greater share of attention than heretofore. The concentric ring, which a few years ago was practically unheard of, is now used quite extensively, and there are several other types of rings built in sections that now are becoming popular. The most prominent trend at present is toward the use of a number of concentric rings, say three or four, very thin and made of steel, in each piston ring groove. With these it is unlikely that the splits will line up and so permit the gases to escape, and there is less likelihood of the gases passing behind the rings.

Wanted—A Gasoline Separator.—Now that the Mayor of the city of New York has placed his veto upon the measure which would have repealed the ordinance making compulsory the equipment of public garages with what have come to be known as oil separators, attention naturally will center upon these devices if for no other reason than because the garagemen have so consistently fought against them upon the grounds that they will not prevent gasoline and oil from entering the sewers, which is their purpose. Notwithstanding numerous sewer explosions it is claimed that the quantity of gasoline that finds its way into the sewers is so small that the separators of which there are several types, will not serve their purpose. If this is so, it would seem that there is ample room for the exercise of genius in the evolution of a device which really will separate the oil and gasoline from the water and hold it.

Letters from the Firing Line

By an Officer in the French Army. Special War Correspondent of the Scientific American

I HAVE spent a part of the night going over my war diary, and have picked out the facts which, I thought, would interest you most. Do excuse the careless way in which I write, *a laguerre comme a la guerre*. It is night. My table is a drum and my lamp a wax candle, which blows out with each gust of wind. We expect at any moment to hear the call to arms, for the enemy is looking for a chance to surprise us. He will not find us asleep!

When you receive this letter the engagements which have taken place from the Belgian frontier, extending almost to the walls of Paris, will perhaps be already forgotten. Other engagements of no less importance are now going on at different points of the line.

You probably have learned, through the newspapers, that the battles fought on Belgian territory have been of the fiercest kind. It is also superfluous to tell you that the *"tenue au feu"* (behavior under fire) of our infantry is above all praise, and that the efficiency of the French artillery has proved to be superior to that of the enemy, notwithstanding the heavier weight and greater number of the German pieces of artillery. I will not give you in any detail my impressions on the field. Frankly, it is rather disagreeable to hear the shriek of the shells overhead, to say nothing of the prolonged and deafening roar of your own and the enemy's artillery. However, before having experienced it, I thought it would be harder to stand than I really found it. At first, this terrific din and concussion of the artillery duel produced severe headaches.

Heartbreaking, and far more tragical to see than the fight itself, is the aimless flight of the terrorized population before the invader.

Each day our heart hardens a little more. It is as well that it should, for the soldier who is called under fire. Neither good nor bad news affects our nerves. Offensive, defensive, charge, retreat, victory, the words have lost their heart-stirring, their emotional effect, and we obey orders almost automatically. A blind force seems to drive us. We do not want to see—we close our eyes when along the highway comes rumbling a train loaded with wounded soldiers. We do not want to think, and if on the list of the dead we see or hear the name of a comrade, of a friend, of a chief fallen on the field, we try to forget.

Our lines are crossed incessantly by villagers in tears—men, women, and children—some on wagons, some on foot carrying their belongings in a bundle tied at the end of a stick. Most of the time they do not know where they are going; they simply go, hoping to find, somewhere, a refuge. A few days ago we stopped in a deserted village to rest after a long march, and we found on a farm an unfortunate woman alone. She was lying on a litter of straw, and clasped in her arms a child to whom she had just given birth.

One of the most appalling sights, to which even the most hardened among us cannot remain insensible, is that of the starving children who surround us at meal time. They beg for food, like famished dogs they pick up from the ground the crusts we cast away, and no one can stand the look of hunger on their pale little faces.

The service of the field kitchen is well organized. Our *"boulets de soin"* (wholewheat bread), nicely browned by expert cooks, are served us with the most precise exactitude. There is not a squadron or a regiment which cannot boast of a cook who knows at least six different ways of serving a piece of beef. When we depart for the field, our knapsacks are heavy with all the eatables which have been distributed to the men. But if the soldiers have plenty of food supply, the poor villager has nothing to eat. Yesterday two little girls said before me: "We have not eaten for two days; there is not a crumb of bread at home." Each day the number of people who come to beg for what is left of the soldiers' soup and bread is greater and greater.

The other evening Charleroy was in flames! I watched the colossal holocaust, and it called to mind that tragical hour of the Roman Empire, the burning of Rome.

If the unfortunate villagers and those of our wounded who had been spared in the slaughter had not told us of the cruelty of our foes, it was enough to see the sinister conflagrations of the towns and villages, to understand that neither the Vandals nor the Huns would have shown such a useless ferocity in their devastations.

I cannot remember without a pang the sorrow of that priest, a tall old man with white hair, who was crying at my side, while the incendiary flames were devouring the town. "I do not see," he told me, "why God imposes life upon me. I cannot close my eyes without seeing corpses, ruins, and blood everywhere. I want to be among my flock in the cemetery. My body is here, but my soul is with the dead, the many innocent victims whom I mourn."

I witnessed a few days ago an interesting scene. After a short encounter, our troops succeeded in repulsing the enemy, who evacuated the village. No sooner had the invader left than all the inhabitants reappeared and hurried toward the fields to harvest the crops. They worked silently, peacefully, driving the horses, who avoided the dead bodies lying in the wheat.

As soon as the battle of Hucien was fought the same laborers cut and housed their crops; afterward they returned again to their fields and dug graves, where they buried, after counting them, thousands of dead.

Our women, the girl in her teens as well as the white-haired grandmother, take the place of the missing men, and work from dawn to night to harvest the crops. They do all that is humanly possible to help the nation.

To check the invader is for us a matter of life or death. It is impossible to say on which side the toll of death is the greatest. In the region where I am, the north end of France, which is known as one of the most fertile of the country, the apple trees shelter the dead by the hundreds. Everywhere one sees corpses and from the woods comes an insufferable odor.

After three days and three nights of fighting along the River Sambre, we succeeded, in the dark of the night, in surprising the enemy, and inflicted severe losses. The number of the dead lying along the canal of the Sambre was so colossal that we were obliged to take another road. Yesterday I was in the hospital, when two wagons drawn by oxen brought their cargo of wounded. In the first cart were three Germans, and in the second two Frenchmen and two Germans. The nurses, prompted by their patriotism, rushed to the second cart, desiring to attend first to the French soldiers, but the army surgeon stopped them and said: "Bring the wounded in the order they arrive." And without taking notice of the nationality, he and his assistants began their humanitarian task.

A young soldier, a Turco, hardly twenty years old, was brought into the hospital. His arm and thigh were badly torn; but he refused stubbornly to let go his gun. "What do you think," the army surgeon said to me, "this boy won't part with his bayonet; and we had a devil of a time to dress his wounds. He threatened to tear the bandage off, if we took his gun away. He is a brave—three bullets in his right arm, his side in a mess, and the femur bone broken by a shrapnel." At night the young Turco lays his gun by his bed, and in the morning his first inquiry is for it.

Our offensive has not succeeded yet in holding back the enormous army of the enemy. We were forced to take again our positions of defensive, which are yet intact. The impetus of the German army is terrific. They realize that their only chance is in a quick action. Feeling already the Russians at their heels, they throw themselves furiously on France in their mad desire to be done with us in time to turn upon their Russian foe.

Their only thought is to advance, no matter how heavy the cost of lives. With an unflinching will and a cold frenzy, the great chiefs of the German army sacrifice every day. In the face of our cannons, thousands of their best soldiers. It would look as though they had taken an oath to smother us under the avalanche of their corpses.

The German army possesses more machine guns than the French, and in their haste to vanquish us by their fire, and turn their forces on the Russians, they are lavish of the lives of their soldiers.

In rifle fire the two armies are equivalent; but our artillery is far superior to theirs, and also our bayonet and sword.

We are still retreating toward Paris. We will reach there to-morrow at the latest. All along the roads the bodies of the unburied soldiers are mixed with the carcasses of the horses. Among the former I recognized some faces. One had been my chum at college. I had loved that tall boy whose body lay across the road.

Yes, we are retreating on Paris, and as we near the French capital, the determination to win, to vanquish the enemy, no matter what the cost, grows stronger within us!

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The Current Supplement

THE front page of the current SCIENTIFIC AMERICAN SUPPLEMENT, No. 2024, for October 17th, shows the first big ship built in England that is powered with a Diesel oil motor, and besides the view of the engine room there are other illustrations of the mechanical equipment. Projectile Photography tells how to make pictures of bullets in full flight with simple apparatus. The interesting article on the Germplasm is concluded. There is a timely article, with excellent illustrations, describing a portable hangar for housing big airships in the field. The proper lighting of courts to enable visual evidence by modern methods to be presented brings up a matter of great importance that has heretofore been almost inexcusably neglected. There is an interesting article on explosives, by an English authority; the influence of forests on climate is explained and shown by many references by an Australian expert; Theories on the movement of the moon are reviewed and compared with observations in an article that calls attention to the desirability of further work on lunar problems. Other articles tell of experiments to prevent fog; first aid to the wounded; the last wild pigeon; and various other informative matter.

Ships Destroyed by the War

A MARINE insurance firm in Amsterdam has issued a list of vessels that have been lost as a result of the war, which includes a number that have not heretofore been reported. This list is believed to cover all that have been lost up to September 10th.

The following British steamers were lost, as described:

"Craigforth," 2,900 tons, struck mine near Constantinople and sank; "San Wilfredo," 6,458 tons, struck mine near Wilhelmshaven August 10th and sank; "Hyades," 3,252 tons, sunk by German cruiser on August 10th, near Pernambuco, "Kaipara," 7,392 tons, sunk by "Kaiser Wilhelm der Grosse"; "Nyanga," 3,066 tons, ditto, "Holmswood," 4,223 tons, sunk by German cruiser "Dresden"; "Howes Castle," 4,650 tons, sunk by German cruiser "Karlsruhe"; "Barley Rig" (drifter), struck mine in North Sea and sank; "Thomas W. Irwin" (trawler), ditto; "Crathie" (trawler), ditto; "Tubal Cain" (trawler), 227 tons, ditto; "Sefi" (trawler), sunk by Germans; "Ajax" (trawler), struck mine in North Sea and sank; "Eyrie" (steam drifter), ditto, "Lindsdell" (steam drifter), ditto; "Runo," 1,679 tons, ditto; "Valiant" (trawler), sunk by Germans; "Viry" (trawler), ditto; "Imperialist" (trawler), struck mine and sank; "Revigo" (trawler), ditto.

The following British vessels were also sunk by the Germans; "Argonaut," "Capricornus," "Lobelia," "Harrier," "Chameleon," "Pegasus," "Pollux," "Fideo," "Rhine."

Vessels belonging to other countries are as follows: Steamer "Alcos," 3,233 tons (Dutch), sunk by Russians; steamer "Alice H.," 3,052 tons (Dutch), struck mine and sank near Dago, steamer "Tysla," 4,676 tons (Norwegian), struck mine and sank near Wielingen; steamer "Gottfried," 426 tons (Norwegian), struck mines in North Sea and sank; steamer "Baron Gautsch," 2,069 tons (Austrian), struck mine near coast of Dalmatia and sank; steamer "Bathori," 2,223 tons (Austrian), near Spanish coast sunk by H. M. S. "Minerva"; steamer "Carl," 3,336 tons (German), sunk by Russians in harbor of Omega; steamer "Erika Fischer," 1,300 tons (German), ditto; steamer "Karl Fried Larsen," 1,500 tons (German), ditto; steamer "Königin Luise," 2,163 tons (German), sunk by British warships; steamer "Kaiser Wilhelm der Grosse," 13,952 tons (German), ditto, steamer "Albatline," trawler (German), ditto, sunk September 15th, steamer "Christian Broberg," 1,225 tons (Danish), struck mine August 21st and sank; steamer "Maryland," 5,136 tons (German), ditto; steamer "Skull Fogel" (Danish trawler), 272 tons, struck mine August 27th and sank; steamer "Gaea" (sailing vessel), 235 tons (Danish), ditto; steamer "Karma," 1,270 tons (Danish), ditto; steamer "Express," 717 tons (Russian), struck mine near Otchakoff August 11th and sank in 10 minutes (54 persons lost); steamer "St. Paul," 2,534 tons (Swedish), struck mine in North Sea September 2nd and sank.

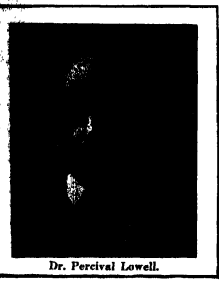
London Traffic

THE English Board of Trade has published an interesting statistical account of traffic in London. While the number of inhabitants in London has increased from 6,710,272 in 1903 to 8,471,146, the number of journeys per head per year has increased from 145 to 244. The number of passengers on electric tramways was 763,797,850 in 1910, 821,810,714 in 1911, and in 1912 descended to 797,487,581. The number of people transported by motor-bus has continually increased. It was 377,207,550 in 1910, 400,628,487 in 1911, and 551,622,398 in 1912. Owing to the protective devices employed, the number of accidents due to electric tramways is very small. Out of 100 fatal accidents, only 1½ are due to the electric tramways.

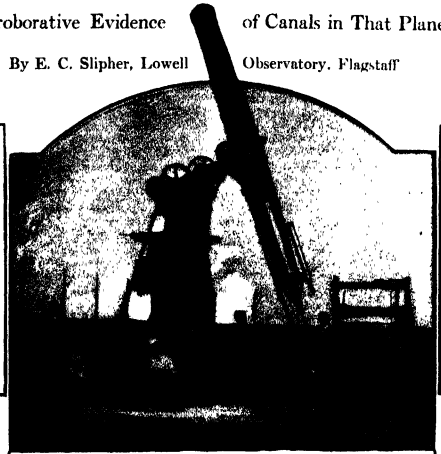
Our Knowledge of the Planet Mars

Corroborative Evidence of Canals in That Planet

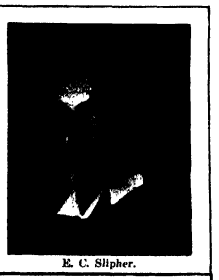
By E. C. Slipher, Lowell Observatory, Flagstaff



Dr. Percival Lowell.



The 18-inch reflector of Amherst College mounted in Tarapaca Desert, at Alianza, Chile (1907), and members of the Lowell expedition.



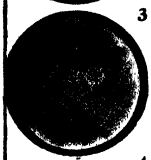
E. C. Slipher.



1 JUNE 2, 1888. MARTIAN LONGITUDE OF THE CENTER OF DISK 240°. DRAWING BY SCHIAPARELLI MADE AT MILAN, ITALY.



2 (1903.) GLOBE OF MARS BY LOWELL LONGITUDE OF CENTER OF GLOBE 0° (THIS GLOBE PICTURES THE DETAILS SEEN WHEN THESE LONGITUDES DURING THE OPPOSITION NAMED.)



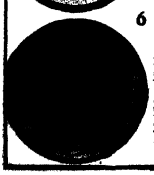
3 OCTOBER 21, 1911. LONG. CENTER 119°. DRAWING BY G. FOURNIER MADE AT SETIF, ALGERIA. JARRY DESLOGES OBSERVATORY



4 JANUARY 12, 1912. LONG. CENTER 190°. DRAWING BY DR. LOWELL WITH THE 24-INCH REFRACTING TELESCOPE



5 OCTOBER 28, 1911. LONG. CENTER 111°. DRAWING BY G. FOURNIER AT SETIF, JARRY DESLOGES OBSERVATORY



6 NOVEMBER 8, 1911. LONG. CENTER ABOUT 180°. DRAWING BY E. C. SLIPHER WITH THE LOWELL 24-INCH REFRACTOR. (NOTE THE STRIKING AGREEMENT BETWEEN THE ABOVE FOUR DRAWINGS BY THREE DIFFERENT OBSERVERS.)



7 JANUARY 21, 1914. DRAWING BY DR. PERCIVAL LOWELL WITH THE LARGE 40-INCH REFLECTOR.



8 JANUARY 21, 1914. BY E. C. SLIPHER WITH THE 40-INCH REFLECTOR. THIS WAS MADE AT THE LOWELL OBSERVATORY FLAGSTAFF, ARIZ.



9 JANUARY 12, 1914. BY E. C. SLIPHER WITH THE 24-INCH REFRACTOR OF THE LOWELL OBSERVATORY AT FLAGSTAFF, ARIZ.



10 JANUARY 8 1914. BY E. C. SLIPHER WITH THE 24-INCH TELESCOPE OF THE LOWELL OBSERVATORY AT FLAGSTAFF, ARIZ.



11 JULY 11, 1907. BY E. C. SLIPHER, AT ALIANZA, CHILE, S. A., WITH THE 18-INCH REFRACTOR OF AMHERST COLLEGE. (NOTE THE CHANGE IN THE CANALS SEEN IN THE LIGHT REGIONS OF THE PLANET SHOWN IN NOS. 11 AND 12.)



12 JANUARY 20 1914. BY E. C. SLIPHER WITH THE 24-INCH REFRACTOR OF THE LOWELL OBSERVATORY, FLAGSTAFF, ARIZ.

No celestial body is of such world-wide interest as Mars. Ever since Schiaparelli discovered the famous "canals" and Prof. Lowell confirmed the discovery and supplemented it with other observations of equal importance, a controversy has arisen as to the interpretation which is to be given to the surface features of our planetary neighbor. Prof. Lowell believes that Mars is inhabited, and that the canals are the work of intelligent beings who seek to save themselves from destruction by an irrigating system far more elaborate than anything we have on the earth.

The accompanying article, prepared by Mr. E. C. Slipher of the Lowell Observatory staff, sets forth the reasons for supposing that Mars is indeed inhabited. Mr. Slipher has been for several years engaged in researches on Mars. His extensive visual and photographic study covers several oppositions of the planet, including that of 1907, when, as the observer of the Lowell expedition to the Andes, he observed the planet in the desert of Chile and brought back a remarkable set of drawings as well as photographs.—EDITOR.

PROBABLY no astronomical subject has created more popular interest or scientific discussion during recent years than has the question of the habitability of the planet Mars. The idea of the possible existence on another planet of life, of another world than ours where intelligent beings may now be living, has awakened, due perhaps to the human factor involved, great interest in the minds of both layman and scientist.

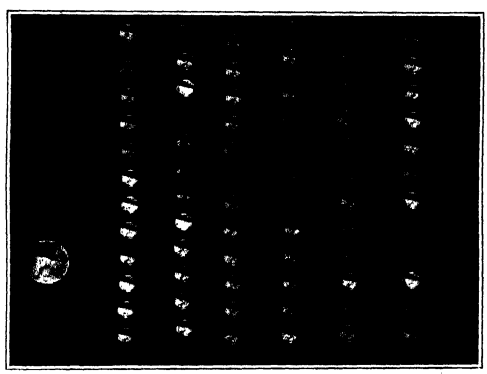
Early observers of the planet Mars, our near neighbor whose path about the Sun lies next outside that of the Earth—saw the polar regions masked with snowy white, and the intervening surface irregularly divided into widely extended light and dark colored areas. These great dark blue expanses, because of their color and general similarity to our oceans, were believed by astronomers generally, prior to about 1890, to be large bodies of water and were termed accordingly "seas"; likewise the large reddish-yellow regions which constituted the greater portion of the planet's surface, from a similar reasoning, were considered "continents," and the smaller dark patches entirely surrounded by light areas were known either as "lakes" or as inland "seas," and the small light regions partially or totally encircled by the ocean waters as "peninsulas" or "islands."

Schiaparelli Discovers the Canals.

The year 1877 marked a new era in important Martian discoveries. During the planet's favorable approach to the Earth in that year Schiaparelli, the great Italian astronomer, while engaged in determining the Martian latitudes and longitudes of fundamental markings on the planet's surface in the preparation of an accurate aerographic map, discovered the "canals." As these newly discovered features matched in tint the lakes and seas, he naturally thought them to be channels connecting the then supposed seas across the land. For this reason they received from him the name "canale"—rivers or channels. In his subsequent memoir, in speaking of these linear markings he says: "Proctor's four great continents are now broken up into a multitude of islands, and it would seem that this work of cutting into small pieces must proceed yet further. No continuous great masses exist on Mars, but the entire dry surface of the planet is divided into an extraordinary number of islands. This peculiar and unexpected distribution of the seas and continents of Mars, which forms a striking contrast with what is seen on the Earth, is made evident at a glance at the map, whose network of canals must not be supposed to be complete; for it really includes only the heaviest lines and

those most easily seen at such a great distance. Speaking of glimpses he had during his observations of October, 1877, upon two or three occasions of exceptional steadiness of atmosphere, he says: "Such, however, was the minuteness of the details, and so fleeting the duration of this condition of things, that it was not even possible to form a very clear and certain idea of the things seen, and there remained only a confused impression of a fine network composed of *delicate lines* and *minute spots*." He quotes a similar observation by Secchi on June 29th, 1858.

Although some objection had been raised against believing dark regions of the planet to be due to water, these ideas of the constitution of the planet's features held for a considerable period. They were then most plausible certainly, since the most reliable investigations of that time led to the conclusion that the planet possessed a rather dense atmosphere. Not until the year 1892 was observational evidence secured that proved beyond doubt that the dark blue regions of the planet were not seas of water. In that year W. H. Pickering observing at Arequipa, Peru, detected in these seas markings having permanent positions, which he called lakes and river systems. Douglass in the same year observed at the Lowell Observatory line-like markings in the dark areas of the planet which had the same geometric character as the canals and oases seen in the light regions. This marked a transition. Lowell then discovered that the canals had a faint and an intense period or a "live" and "dead" season, and in 1894 he announced the theory that the canals and lakes of Mars were not water, but strips and oases of vegetation sustained by an artificial canal system fed by the waters of the melting snow caps. This theory accounts for the remarkable changes occurring in the peculiar network of markings over the planet's surface, and as a fitting hypothesis to the observed conditions it has no competitor, satisfying as it does all the facts brought out by the observations. The observations indicate a close connection between the melting away of the polar caps and the intensification of the canal system, and as on the earth, the development of these marks of vegetation appear to follow lotteringly the march of the Sun as it passes—doubly slow as here on the Earth—from one hemisphere over the other.



Drawing of July 12th, 1907, by Dr. Lowell, at Flagstaff.

Photograph made July 13th, 1907, at Alianza, Chile, with the Amherst College telescope, by Mr. E. C. Slipher. The details in the photograph cannot be reproduced by the half-tone process, but the Editor of the "Scientific American" has seen the oases in them.

Mars—A Planet That is Slowly Drying Up.

Older by cosmic eons than the Earth, and farther on in planetary evolution and development, Mars has but a meager supply remaining of either air or water. Therefore, it is supposed by Lowell that this network of canals and oases comprises an artificial system of irrigation intelligently constructed to utilize and distribute the water from the melting snows over the desert planet. The visible markings, of course, are not the actual waterways themselves, but blue-green strips of vegetation sprung from this irrigation. Two significant facts found by the observations here suggest, more than any other perhaps, their artificiality and otherwise substantiate his theory; first, the marked geometric directness with which the canals, in general, connect with the oases and isolated points, which makes them appear quite similar to a distant view of a system of many railways; second, the characteristic manner in which they seem to push out from, and develop with, the melting of the snow caps.

The observations of a number of astronomers evidence the fact that the canals and oases change, markedly, in intensity at different intervals. The photographs of these markings, made here, confirm this. As early as 1877 Schiaparelli noted the disappearance of certain canals, but he attributed it to Martian clouds. Concerning this phenomenon, he says: "This variability I believe only apparent, and due to the passing of light clouds over the lands of Ophir and Tharsis." Water vapor was shown to be present in limited amounts in the atmosphere of Mars by photographs of its spectrum made at this observatory in 1908 and confirmed by many more obtained this year. However, Martian clouds are very rarely observed, and appear as dust storms seen along the terminator, so it seems that the changes he saw in the canals were not apparent and due to clouds as he thought, but real, and due to seasonal variations in the canals.

Schiaparelli never advanced the theory of artificiality of the Martian markings, but with the insight of genius and through open-mindedness he wrote, late in life, to Lowell: "Your theory is becoming more and more probable."

I shall not pass unnoticed the fact that since Schiaparelli first saw the canals a spirit of skepticism has prevailed regarding their reality.[2] The observations of those who have seen the canals have met with considerable criticism and various theories of illusion have been expounded to explain away these details. However, much of this so-called criticism comes from those having very little if any first-hand knowledge of this branch of astronomical research. It is understandable why one inexperienced in this study would fear the chance of seeing illusory details, but practical experience in these observations will suffice to prove such a fear unwarranted. The truth is that illusions are not highly probable things, as some seem to believe, but, on the contrary, in actual practice to the trained eye they are found to be very highly improbable if not impossible. Experience enables one to distinguish the real from the fictitious at once, and the skilled observer does this unconsciously. Practical tests at the telescope are far better than any amount of theory or reasoning; and if those who devise and advocate theories of illusion to explain such planetary details would try practical applications to see where their theories lead, few if any would be mentioned. It seems both sufficient and necessary in this connection to state that almost all ideas of illusion have been investigated here in years past, and they have all been found defective or inapplicable, both by experiments and by the observations themselves.

As a matter of fact, all of these details, even the faintest canals, defy explanation as illusions. This is evident for two reasons. First, because they bear the same stamp of reality as the obvious details; secondly, because a canal that is at one time quite faint becomes at another period so markedly intense as to rival in visibility any detail on the planet.

Why Good "Seeing" is Necessary.

Favorable conditions of atmosphere are of course the essential factor in observations of the surface details of planets; second only to this stands the importance of eyesight. By good atmospheric conditions is not meant clear skies only, but rather the tranquillity of the air; upon the latter depends the clearness and steadiness of the telescopic image. It is also true that the greater the aperture of the telescope objective, the greater the disturbing effect of the atmosphere and the less well defined the image of the planet will appear. Thus it will be seen that what is seen on the planets is limited first of all by the condition of the air through which we must observe rather than the size of the telescope. It should be noted in this connection that the Lowell Observatory was located at Flagstaff—elevation, 7,250 feet—after investigating atmospheric conditions at many other places. The only other telescopes of which I am aware that have been located after such a search for excellent conditions of atmosphere are those at the observatories of Jarry-Desloges at Massegros, France, and at Setif, Algeria. The steadiness which he has met in seeing these Martian features, and the striking agreement of his drawings of them, made with those made here, are at once evident and remarkable. (See Figs. 3 to 6 in accompanying plate.)

With good seeing, good eyesight, and moderate magnifying power, these Martian details are not especially difficult objects of vision. The remarkable concordance of the results obtained by the many observers who give time to this planet shows that they see true markings. It is a significant fact that those who have sought out the best atmospheric conditions are seeing the canals best and in the greatest numbers. The crux of the situation is, it seems, that those who wish to discredit the existence of the canals will not make the conditions favorable for their visibility.

It is found that by diaphragming the objective and by using a dark glass over the eye-piece of the telescope, the definition is markedly improved. Not only are the shaded glass and diaphragm correct in principle, but are proven in practice to be important aids to seeing planetary detail. With a magnification of nearly 400 on Mars the best results are usually obtained with apertures of from 12 to 18 inches. This same magnification which is the one most used gives an image of the planet at its near approaches to the Earth, whose surface is about twenty-five times as great as that of the Moon viewed with the unaided eye.

If telescopes of large apertures fail to reveal the canals and oases of Mars to an observer of good eyesight under favorable conditions of atmosphere, it must be due either to insincerity of purpose or to the disregard of such principles as mentioned above. They have been seen here with both the 24-inch refractor and the 40-inch reflector, and with apertures anywhere between 6 and 40 inches. They were also seen by me through the desert air of the Tarapaca in Chile, with a three and one half inch telescope and with the excellent 18-inch refracting telescope of Amherst College. This forms conclusive proof that they are not functions either of reflector, refractor or of aperture.

Furthermore, an absolutely incontestable proof of the reality of the canals and oases of Mars is furnished by the photographs of them. The size of these photographic pictures of Mars, taken when it is near the Earth, is from four to six times greater, in surface, than the Moon to the unaided eye. True it is that the markings on the planets cannot be photographed as clearly as they can be seen visually, due to the fact that the sensitive emulsion of the plate requires a longer time to receive its impression than does the eye, and consequently the resulting photographic image is subjected to more atmospheric disturbances and becomes more or less blurred; but in spite of this great handicap, a majority of the canals and oases have left their impression on the photographs. Some of the double canals have also been photographed as such. About twelve or fifteen would perhaps be a fair average of the number of these markings visible on a plate of a single region of the planet. Thus, many of the canals and oases have been recorded on the photographs, not once, but many hundreds of times over, by the tens of thousands of photographs obtained here since Lampland first succeeded in photographing them in 1905. Aside from this corroborative evidence, they also show the distinct changes in the intensity of these markings which occur from time to time.

There is nothing in terrestrial topography or the markings on other planets that is comparable to the markings on Mars. In all, about seven hundred canals and oases have been observed here in the complicated network which covers the planet's surface.

We are no longer concerned with the discovery of new markings, but are pursuing a more detailed study of their appearance and behavior in search of the key to this most engaging riddle of the solar universe.

Windmill with Emergency Connection to a Stationary Engine

WIND-POWER is one of the cheapest forms of power at our disposal. Unfortunately, it has the serious drawback of being irregular and intermittent in character. This defect is overcome at some German flour mills, according to *Prometheus*, by running a windmill in conjunction with an engine, which may either supplement the power of the wind continually, or only at times when there is a more or less complete deficiency.

[1] Inability to see an image of the Sun reflected by the Martian waters.

[2] As an illustration of this absurb skepticism a late book "Astronomy—A Popular Handbook," by Prof. Jacoby of Columbia, in treating the Mars subject, says: "The polar spots seem to increase in the Martian winter season, and to diminish in the summer." That the polar caps do change in this precise manner is an observed fact, and has been known since instrumental means made such observations possible a half century or more ago.

ork Electrical Exposition

w York Electrical Exposition which the Grand Central Palace (October t feature any of the heavy machin- lectricity, the multitude of applica- impresses on the visitor the almost of this wonderful agent; for no upation or interests may be, some- in this unique collection of elec- will appeal to and interest him. are, the Government has contrib- hibits of popular interest, and the mint, which illustrates practically the production of a twenty-dollar exhibition of the electrical equip- are again to be seen, as well as the by the Bureau of the Census. In electrically operated series of cart- nes from the Frankford Arsenal, n at the Panama-Pacific Exposition, the various processes for making both and those used in rapid-fire guns. The War Department has a most interesting and timely exhibition of field signaling methods as employed by the United States Army, including a hand-operated generator so small and compact that it can be carried on the back of a mule, and yet powerful enough to be of most valuable service in a campaign In this connection it may be noted that in the Navy exhibit there is a wireless outfit, such as is used on all war vessels, in actual operation, and the visitors can hear actual messages being transmitted both between the various naval stations and between the men-of-war in this vicinity.

In the department of commercial exhibits there hardly is an industry that has not profited and been simplified by the aid of electricity, and while there is a host of apparatus that will interest the user of power in every direction, there is an equally large number of applications in the affairs of every-day life that will appeal to everyone. The restaurant is there, with its electrically operated ranges and other labor-saving devices, as well as the dairy, with its real cows that are milked by electric power, and the processes of pasteurizing, bottling, and butter making are there, electrically conducted, as well as a complete ice cream plant. A novelty is the bakery in full operation, turning out a variety of attractive cakes, all of the operations of sifting the flour, mixing the dough and baking, as well as other subordinate operations, being performed with the assistance of electric power

To the New Yorker who is accustomed to seeing men at frequent intervals working over a maze of wires in excavations and manholes in the street the exhibition illustrating the construction of the subways in which the thousands of miles of wires for the telegraph, telephone, power and many other purposes are accommodated will be of particular interest, as they convey some idea of what these men are doing and how these wires are laid And an especially interesting feature of this exhibit, which includes actual specimens of the underground constructions which enable this distribution of electricity to be made, is a model showing a specimen of the sub-surface constructions that exist under the streets of a city, making it evident that the ground beneath the surface is often full as crowded as the street above, and by no means in as orderly a manner One of the most sensational pieces of apparatus shown is an oscillating transformer outfit for testing the big porcelain insulators that are used on long distance transmission lines, although it can also be applied to the testing of almost any insulating devices A defective insulator on such a line not only means a wasteful loss of current, but is often an element of danger where high-tension currents are being transmitted, and the expense of searching these out and replacing them is considerable By means of this compact testing set, which takes 2¼ kilowatts from a 60-cycle, 110-volt circuit and delivers it at 125,000 volts, the largest and most expensive insulator can be satisfactorily tested, and all its weak points searched out without injury. To see this outfit in operation, with the great crackling arc across its sphere gap, is an object lesson to the uninitiated.

Of lamps of every size and description there is no lack, as well as many kinds of batteries; and these lead to the very practical display of commercial vehicles, which put forth strong claims for simplicity and convenience. Another device that appeals to the public is a water sterilizer that acts directly on the water as it is delivered, the operation of turning on the water also starting the sterilizing apparatus, which operates by the application of ozone. So efficient is this system claimed to be that it will, in a large apparatus, completely sterilize the worst sewage. Another every-day outfit is the barber shop, in which electricity furnishes hot water, a steam sterilizing drum, vibrators, and a hair singeing device.

Of the household devices there are legions, all tending to simplify and lighten the work of the family, and consequently universally attractive; but among these there is little of novelty, except it be in refinements. Taken as a whole, this exhibition, while interesting and instructive to the electrician, is particularly attractive to the layman, and probably this is the direction of the greatest value in shows of the kind.

Electric Death

A Suggestion for Its Prevention

By Phillip E. Edelman

THE writer happened to be on hand at one of the recent accidental electrical deaths and feels that many of these family robbing incidents could be easily prevented. It was the old story of the 2,000 volt line not being a sufficient distance away from surrounding trees, barns, etc. The unfortunate victim was caught while engaged in the work of trimming a tree, the 2,000 volt line being substantially in contact with the tree

Now, aside from these occasional and too frequent accidents, the writer, and doubtless others, has noticed that there is a grounding at many points where such wires touch tree tops; sparks may often be seen passing between the wires and the branches of the tree

With the knowledge that higher poles are more expensive and that underground conduits are very costly, the writer would still suggest that every municipality granting right of way for a high voltage line should require such wires to be separated from all surrounding objects by a distance of not less than eight or ten feet. This may mean the use of higher poles at parts of the line or even lengths of insulated cable, but the cost would be offset by the consequent freedom from line loss, danger of breaking wires, and still more, in the saving of valuable civilian lives.

The public ought to realize that the same wire which may only be three sixteenths of an inch in diameter and look very innocent, is capable of transmitting many kilowatts instantaneously to a human body, and comprises, in fact, a high power death-dealing electric gun Two thousand volts at only 1 ampere is equivalent to the force of more than two horse-power; applied electrically to a small portion of a body, it acts much like a bullet as far as its power effect is concerned.

The writer has been informed by a transmission line engineer that foolish huntsmen constitute a menace to high tension transmission lines, because with the cowardly bravery of non-publicity they shoot at and hit the life and line-saving insulators So far has this menace proceeded that special steel-clad bullet-proof insulators have had to be designed The repair of such a high tension line is no child's play, and the foreman takes considerable responsibility when he sends back word to the power-house that the line is clear Should a single lineman remain on the pole when the 13,200 or higher voltage supply is turned on, instant death is a probability.

Again, it should be said, "Respect, don't fear, electricity, but use every precaution for safety." It is not safe to have a loaded gun pointed at a good citizen; it is no safer to expose him to the bare or insufficiently insulated "electric gun." The use of electricity is entirely safe if only it is properly transmitted and applied; misused it has no mercy and spells DEATH

Sex Differentiation

IN his presidential address before the British Association for the Advancement of Science, at Melbourne, Australia, Professor William Bateson in discussing Heredity considers how the characteristics of a population of differentiated members would be distributed among their offspring, and he has the following to say in relation to this problem: "Formerly it was hoped that by the simple inspection of embryological processes the modes of heredity might be ascertained, the actual mechanism by which the offspring is formed from the body of the parent. In that endeavor a noble pile of evidence has been accumulated. All that can be made visible by existing methods has been seen, but we come little if at all nearer to the central mystery We see nothing that we can analyze further—nothing that can be translated into terms less inscrutable than the physiological events themselves. Not only does embryology give no direct aid, but the failure of cytology is, so far as I can judge, equally complete. The chromosomes of nearly related creatures may be utterly different both in number, size, and form. Only one piece of evidence encouraged the old hope that a connection might be traceable between the visible characteristics of the body and those of the chromosomes. I refer, of course, to the accessory chromosome, which in many animals distinguishes the spermatozoon about to form a female in fertilization. Even it, however, cannot be claimed as the cause of sexual differentiation, for it may be paired in forms closely allied to those in which it is unpaired or accessory. The distinction may be present or wanting, like any other secondary sexual character. Indeed, so long as no one can show consistent distinctions between the cytological characters of somatic tissues in the same individual we can scarcely expect to perceive such distinctions between the chromosomes of the various types."

Correspondence

[The editors are not responsible for statements made in the correspondence column Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

An Opinion of Our War Number

While I have already expressed it verbally, I want to put in writing my appreciation of the War Number of the SCIENTIFIC AMERICAN

It is full of just the sort of information that I shall want to keep right at hand for reference many times during the progress of the conflict It is all handled in a very effective and interesting way

EDWIN A WALTON,
Advertising Manager of Timkin Roller Bearing Co
Detroit, Mich

Rabbits in Oil Pipe Lines

To the Editor of the SCIENTIFIC AMERICAN:

I note in the issue of your paper of the 22nd ultimo an article entitled "Strange Animal Tragedies," that I inclose, stating that in the process of laying the pipe lines of the Midway Field the lines have to be taken up to take out the rabbits This is rather misleading The rabbits do get into the lines, but in the process of laying pipe for many years, there is one man assigned to the duty of carefully examining every joint just as it is screwed to the last just laid, to see not only that there are no animals in it, but also, what is much more likely, that there is no dirt in it, and pipe lines are not taken up to take rabbits out of them, as the last part of the article would indicate was a common practice The duck part of the story is correct They do alight on the oil, thinking it water, and usually perish, notwithstanding that there is a lake six miles wide within seven miles of and in plain sight of the oil ponds

Taft, Cal J W. SQUIRES

The Indomitable Engineer

To the Editor of the SCIENTIFIC AMERICAN:

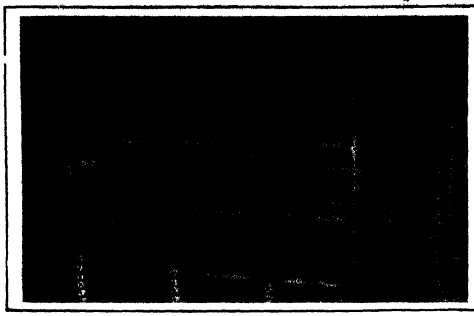
I have read with interest your editorial of the 22nd ultimo, entitled "The Indomitable Engineer" The engineer until quite recently has received but little praise or reward for his great share in the upbuilding of our comparatively new and great country Even in our times, his projects and improvements began with pioneer work in road and railway building, and have reached a consummation in such impressive works as the Panama Canal, the Pennsylvania Tunnels and Hell Gate Bridge, and great buildings, bridges, and subways, excellent examples of which will be found in New York city.

In the illustration you take of our Hell Gate Bridge across the East River, your appreciation of the unnamed engineer, Gustav Lindenthal is exceedingly well deserved. His persistency, resourcefulness and ability to surmount any engineering difficulty entitle him to be regarded as one of the great engineers of the present generation A J COUNTY,
Special Assistant to President of the Pennsylvania Railroad Company
Philadelphia, Pa

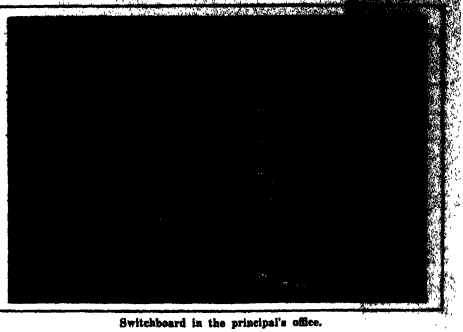
Our Latin American Opportunity

UNDER the above title we published in the SCIENTIFIC AMERICAN of October 3rd, an article by John Barrett, director-general of the Pan-American Union. By an unfortunate slip, the sub-title "An El Dorado for Our Business Men" was used This was done entirely on our own responsibility and without permission of the author It expresses an attitude entirely at variance with that of Mr Barrett, who has been emphatic in stating that the field is in no sense an El Dorado, but simply a great legitimate, natural opportunity, which, however, is suffering from serious financial stringency In calling our attention to the sub-title, Mr Barrett writes

"Of course, I realize fully that whoever put that subhead in had little thought of the embarrassment it would cause me or he would not have done it You would be surprised to notice how a thing like that attracts attention, for at least a dozen persons have already spoken to me about it It came in as particularly inopportune because we recently sent out a circular in which we used the word "El Dorado" and emphasized the fact that there was *no such condition* of commerce in Latin America Then, again, in the meeting the other day of the National Committee appointed by Secretary Redfield to consider the trade situation in Latin America, I made a particularly earnest appeal to the business interests of the country to prevent the idea spreading throughout *the land that* there was an El Dorado for American commerce in these countries. All this will enable you to see that my embarrassment was quite acute"



Electric heating units in the furnace room.



Switchboard in the principal's office.

The Electric High School

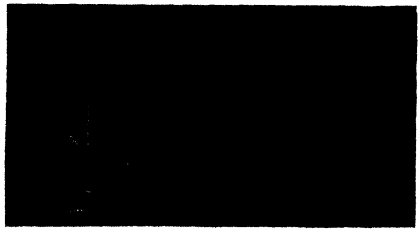
A Building Heated by Electricity

By G. L. Dilworth

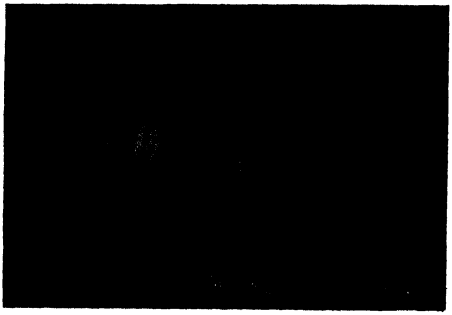
TO the high school of Rupert, Idaho belongs the distinction of being the first large building in the world to be exclusively run by electricity. In this building electricity is also used for a wide variety of other uses, and hence it has come to be called the "Electric High School."

Rupert is the metropolis of the Government Minidoka Irrigation Project on the Snake River, a region which eight years ago was a sage brush desert, but which now is a densely settled farming community, forming the new county of Minidoka with Rupert as its county seat. The settlers on this project are intensely progressive and are determined to have for themselves and their children advantages, especially educational advantages, that will equal those of the best and most progressive cities of the country. For this reason they have provided buildings, equipment, courses of study, and teachers equal to the best. Special instructors are provided for cooking, sewing, manual training, music, drawing, athletics, etc., and all courses are designed to meet the modern idea that they must be practical and of practical benefit.

"The Electric High School" is a three-story building built of mottled-buff pressed brick. On the ground floor there are manual training rooms, equipped with a 10 horse-power motor for driving the ventilating fan and providing power for the lathes, saws, and other machinery necessary in this department, and benches with all tools and equipment necessary for a class of twenty at a time; a sewing room; a cooking room with electric disk stoves and cooking utensils for a class of twenty girls at a time; a cafeteria lunch room; a large gymnasium with galleries for spectators the full length on each side and the open corridor across one end; janitor's supply rooms; transformer room; electric furnace room; plenum chamber; agriculture room; and on opposite sides of the gymnasium dressing rooms, shower baths, and sanitaries for boys and for girls.



Hot-water tank in the plenum chamber.



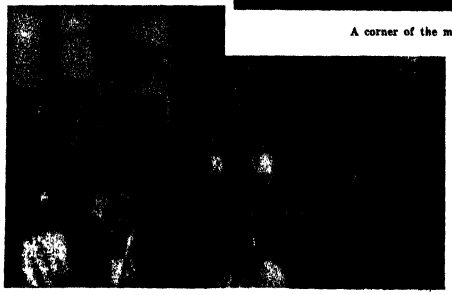
A corner of the manual training room.

On the first floor are library; class rooms; principal's office; ladies' rest room; cloak rooms; and auditorium and stage and dressing rooms.

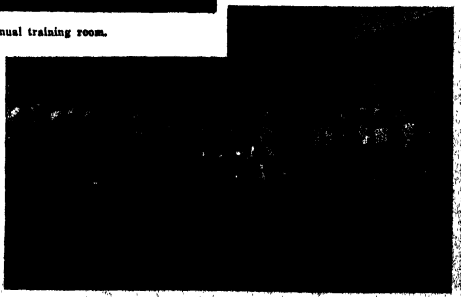
On the second floor are two class rooms, five recitation rooms, and laboratories, cloak rooms, boys' and girls' sanitaries, and janitor's supply room. The science rooms on this floor are exceptionally fine, consisting of a lecture room with raised seats and, on one side, a chemical laboratory with hydrants and locker space for a class of twenty performing individual experiments at a time, and on the other side a laboratory for physics and botany with dark room adjoining for photography. Glass and paneled partitions separate the laboratories from the lecture room.

The auditorium is seated with 800 opera chairs, and has a large stage for theatricals. The electric lighting for the stage is especially fine, being said to be equal to the best theaters. An outlet at the back of the rooms is provided for the use of stereopticon or moving picture machine. The science lecture room is also equipped for the use of the stereopticon and for obtaining current for electrical experiments.

(Concluded on page 325.)



Chemistry room, where electricity is largely used.



Cooking room, fitted with electric stoves.



Fig. 1.—Dynamo machinery at Eiffel Tower.



Fig. 2.—Transmitting keys and control boards.

Radio-telegraphy at the Eiffel Tower

The First Station of an Interconnecting Chain Linking French Possessions

By John L. Hogan, Jr.

FOR several years the republic of France has been working toward the erection and operation of a state-owned chain of powerful "wireless" telegraph stations to interconnect Paris and the French possessions in Africa, Asia, America, and Oceanica. Although the unfortunate complications which arose in the planning of England's Imperial Wireless Chain have been avoided, there have been many delays, and numbers of people are inclined to blame various political and cable-telegraph interests for the slowness in arriving at necessary decisions preliminary to plans for construction. The European nations bear in mind the need of instant communication between the colonies and from them to the capitals, and feel insecure so long as they must depend entirely upon cables. In time of war, when attempts to enforce isolation of distant military forces by the cutting of pole, underground and submarine wire lines are among the first steps of an attack, radio-telegraphy may be depended upon, since the entire plant is localized and may be protected far more efficiently than may any long conductors. Since war clouds are ever present, at least in imagination, speed of erection and in beginning telegraph service has been a first consideration in the several government plans for covering large spans on the earth's surface by radio.

Like other nations, France has had before her the difficulty of deciding upon the proper and best "system" of radio-telegraphy to adopt, and this need of making a choice among the several manufacturing corporations is said to have been the actual reason for delay. It is realized that communication, to be dependable for military as well as civil uses, must be of a sort entirely comparable to that given by cables under favorable conditions. Since the French plan embraces pairs of stations separated by distances as great as 9,000 kilometers (5,600 statute miles), from Guadeloupe to the Marquises, and 6,800 kilometers (4,200 statute miles), from Paris to Guadeloupe, it is essential to select and plan the proposed stations with great care. At present the longest spans covered by "wireless" commercially are between the Marconi stations at Glace Bay, Nova Scotia, and Clifden, Ireland, some 2,000 miles, and by the Poulsen stations at San Francisco and in Honolulu, about 2,300 miles. These pairs of stations exchange messages regularly, but have been sometimes forced to repeat or even to suspend communication temporarily because of severe atmospheric disturbances. The new Goldschmidt stations at Hanover, Germany, and Tuckerton, N. J., are said to have a commercially reliable radius of 4,700 statute miles which separates them. But no one has yet demonstrated the feasibility of regular signaling any farther than 2,500 miles, much less across stretches of 5,000; the difficulties become rapidly greater as the separation increases beyond 2,000 miles, and new problems are brought into the design of apparatus. It is believed by advanced radio engineers, however, that even such great distances as 5,000 miles may be covered dependably by a proper selection of instruments and methods which have already been developed, but which are not widely known.

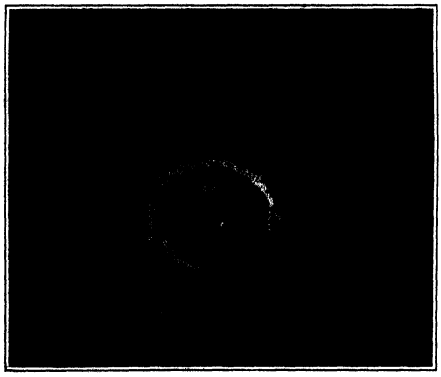


Fig. 3.—The rotary spark gap.

At the base of the Eiffel Tower, in Paris, the government has maintained for many years a military and experimental radio station, and it is here that tests are proceeding with a view toward determining the best types of apparatus for the new high-powered stations. At this station the antenna wires, which are limited in number to six, so as not to deface the tower and Champ de Mars, run from the apparatus house built underground to the tower top, in an inverted fan arrangement. Although the aerial is thus made smaller than it might be if strung from a mast built especially for "wireless," the great height which is reached (984 feet)

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Fig. 4.—Inductance coils and spark gap.

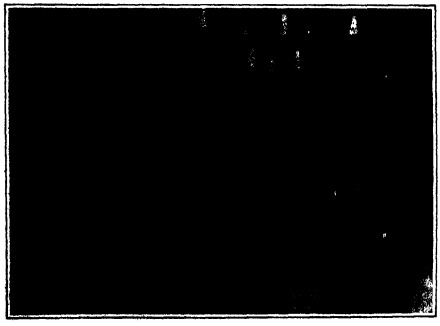
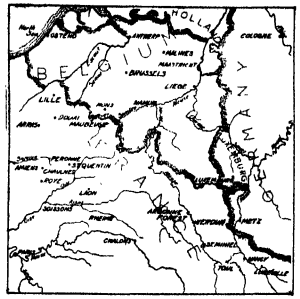


Fig. 5.—Condenser jars, blower and inductance coil.



Map of western theater of the war.

Strategic Moves of the War

Letter from the Military Expert of the Scientific American, October 10, 1914



Map of eastern theater of the war.

The French Campaign

OCTOBER 10th makes four weeks that the Germans have been holding the line along the Aisne River, the Argonnes, and the French border departments. When they first fell back to this line they had the choice between two plans for the strategic use of their military forces. One was to hold the lines in France with minimum force while concentrating their efforts for a time against the Russian invasion, while the other was to use the strongly entrenched lines of the Aisne as a base from which to attempt a new move against the French and British armies.

After the battle of the Marne the French required time to organize their forces and to get started on their aggressive campaign. The Germans seem to have expected this, and to have taken advantage of it to reform their lines and to divert their strength for a time to the eastern field of operations. It is not believed that any German corps were actually transferred from France to East Prussia. This is very unlikely when Germany had large forces of reserves at home ready to move to the front. The diversion of force came from sending to the east even the reserves that would normally have gone to strengthen their local corps in France.

This reinforcement of the German armies in the east enabled them to drive the Russians out of East Prussia and to force them sixty miles beyond their border to the Nieman River. At the same time the Germans pushed forward their armies in Poland to a line running near Plock and Kielce.

The development of the first turning move of the Allies recalled the German efforts to France. They were confronted with two dangers. The turning move, if successful, would force their retirement from their position, won at such great cost. The advance of the French against the German fifth army in the wooded hills northwest of Verdun threatened to cut the German line in two, with much more serious possibilities than the turning move. The first effort of the Germans was to check these two strategic moves of the Allies.

The forces near Rheims were pushed forward in a demonstration to lead the Allies to strengthen this part of their line. Reserves were rushed to the fifth army to enable it to hold its ground. In the north, especially, the Germans were hard pressed to muster the forces needed to oppose the Allies' enveloping attack. This they did by throwing into the front line the reserves from the center of their line, by rushing to the flank a part of their army from Belgium, and by stripping the captured French cities of their German garrisons. Especially was their line strengthened by reserve corps newly brought from Germany, that were rushed to the front by marches that may prove to have set new records for distance and strength of force.

Checked in this first attempt of the army of Gen. d'Amade to reach the German rear, the Allies reverted to an extension of their original project. New corps were rushed to the north behind the shelter of the troops already in line, and the Allies' flank was extended north of the Somme River. Checked again at Albert and Bapaume, the maneuver had to be pushed still further.

For the past ten days the British have been moving to the continent their second contingent. When the proclamation of war was issued by the King on August 4th the army reserves, the special reserves, and the territorial forces were called to the colors. A day or two later Parliament authorized 300,000 volunteers.

In military organization Great Britain has practically the same system as the United States. In fact ours is inherited from them along with the majority of the basic legal and social principles on which our governmental organization is founded. The territorials correspond to our militia, except that the British territorials may be called out for service anywhere in the Empire. The army reserve is composed of ex-soldiers; the special reserve is composed of civilians of special training. Both reserves join the regular army on call for active service; in these only does the British service differ markedly from ours.

From the volunteers and from the detachments of regulars gathered in from all parts of the Empire, Great Britain must by now have organized a new army for service on the continent. Rumors of the move to the front of such a force have come through, but no inkling of its destination. The extension of the left flank of the Allies to the vicinity of Lille indicates the probability of this new British army on the extreme left flank.

To defeat this further extension of the enveloping move of their opponents the Germans attempted the maneuver of breaking through the French line to get in rear of their flank. From the 1st to the 6th of October they made desperate assaults on the lines between the Somme and the Avre and forced the French back to new positions in rear. They were unable, however, to break through. In order to check the German attacks the French had to divert to this field some of the forces intended for extending their flank. The German assaults were to this extent successful in crippling the turning move of the Allies.

Germany is now sending her cavalry into the fight to stop the Allies' turning move. These troops are of little value in the close fighting of the general line of battle. But on the flank their mobility makes them of especial importance. It was by an army of 70,000 men that Gen. von Kluck protected his move during the rapid advance into France of the first days of the war. The French and British have for similar reasons pushed their cavalry forward to their extreme flank, which district will soon witness some of the greatest mounted conflicts of recent centuries. While making every effort to foil the threatening move of the Allies against their northern flank, the Germans have also been trying out the south flank of the French line. By the use of their heavy 11-inch field mortars they have brought a fire to bear upon the line of French forts along the hills on the east side of the Meuse, south of Verdun, that has enabled them to break through the first line of defense. The capture of Fort Camp des Romains at St. Mihiel and the silencing of the forts on either side enabled the army of the Bavarian Prince Rupprecht to push forward to the Meuse River, where they have interrupted the principal supply route for Verdun and the French line to the south.

The object of this assault is not to open across the Cotes de Meuse a route for the main armies to advance. It is rather to get behind the French line in sufficient force to open up to the north or south the routes for the final advance. The strengthening of the French line at this point has thwarted this plan.

The continuous extension to the north of the lines of the opposing forces must be to some extent at the expense of their southern flanks. If much farther continued, the Allies may take advantage of their numerical superiority to work the same maneuver against the German south flank. Such a move would be against their fixed policy, which is to maintain connection with the North Sea ports, but it might be adopted for one move of the campaign.

When the Germans found their first dash into France checked while the Russians were making a victorious advance into East Prussia and Galicia, their general staff had to decide whether to remain on the defensive in the eastern campaign or to adopt the offensive at the expense of the French campaign. It was impossible to make an overpowering effort in both directions, while an equal division of forces would invite disaster in both theaters of operation. Apparently they adopted an intermediate policy. Due to an expected slowness in the aggressive operations on the part of the French, the Germans took advantage of the lull in operations in France to strike a blow to the east. Their central position and their highly developed railway system aided this plan of operations and gave them an appreciable advantage in that they can concentrate the majority of their forces first on one border and then on the other as the progress of the campaign may demand.

This is the strategy that appeals to the Germans. It is that which won success for their king and hero, Frederick the Great, whose campaigns are the pride and boast of every German. By making use of Prussia's central position and the mobility and efficiency of her troops Frederick fought off the attacks of enemies on all sides and turned over to his successor an enlarged and strengthened kingdom. Especially was this advantage of a central position exemplified in his strategy in the seven years war of 1756 to 1763. An echo of this appeared in America in the French and Indian war, in which Washington's military genius showed itself in the salvation of the British column after Braddock's defeat near the present city of Pittsburgh.

In 1756 Maria Theresa, Empress of Austria, succeeded in forming a coalition of Austria, Saxony, Sweden, and Russia, to crush Prussia and return to Austria the province of Silesia that had been wrested from her in the war of the Austrian Succession in 1741-1745. The following year France joined the coalition and Frederick was confronted with a strong army advancing from the west while he was battling with the Austrians and Saxons in Silesia. In both fields the hostile armies largely outnumbered the total Prussian military strength.

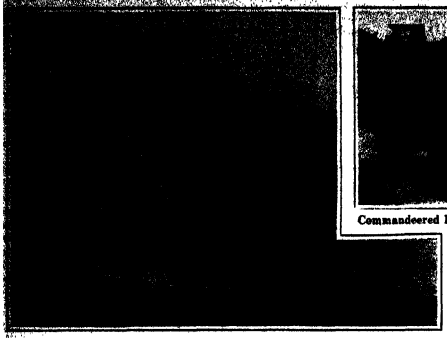
To combat these armies that might have crushed him by mere weight of numbers if they had been allowed to unite, Frederick abandoned the field to the Austrians and moved every unit westward to oppose the French. He concentrated his forces at Rossbach, and on November 5th, 1757, signally defeated the French, though outnumbered three to one.

Leaving the fragments of the French army unopposed, Frederick again collected his forces and hastened back to Silesia to confront the Austrians. This march of 300 miles after a hard won victory over superior numbers is one of the noted military movements of history. Just one month after Rossbach, on December 5th, 1757, Frederick met the Austrians at Leuthen, near Breslau. With 30,000 Prussians he defeated 80,000 Austrians and captured 21,000 prisoners.

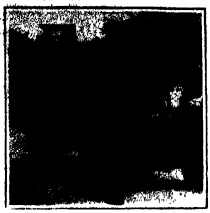
By a continuation of such tactics he was able to stand off his powerful adversaries with such effect that in the final peace Prussia was confirmed in the possession of Silesia. It is by similar movements, much facilitated and expedited by rail and automobile service, that the Germans hope to obtain favorable outcome to the conflict with a similar array of enemies.

Having turned their strength to East Prussia the Germans found that the Russian advance was largely a demonstration. The superior strength of the German forces rapidly forced the Russians back to the Nieman River. Here the German left flank crossed the Olita, on the Niemen, 60 miles north of Grodno, while

(Continued on page 324)



German gun for bringing down aircraft.

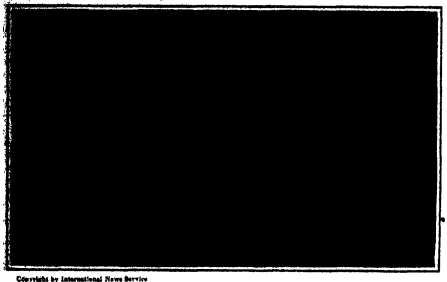


Commandeered British motor truck.



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Wreck of a French monoplane near Namur.



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Unexploded German shells found after the battle of Marne.



A steel bridge at Lagny destroyed by the French.

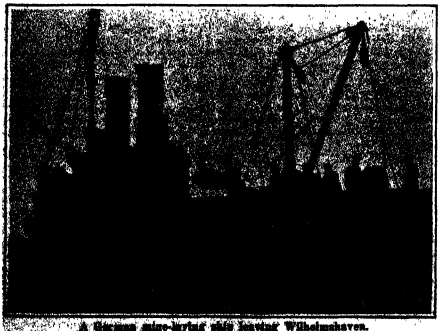


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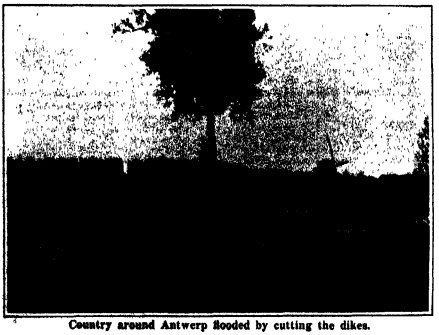
Wreck of a French Red Cross train and the Mary bridge across the Marne.



A German motor convoy destroyed by French dragoons.



A German mine-laying ship leaving Wilhelmshaven.



Country around Antwerp flooded by cutting the dikes.

PICTURES FROM THE FRONT

Our Merchant Marine—Past, Present, and Future

III.—The Future

By Winthrop L. Marvin, Author of "The American Merchant Marine. Its History and Romance"

IN two earlier articles, the splendid growth of the American merchant marine through the first half of the last century, and its subsequent decline, have been described, and the present pitiable weakness of our merchant fleet in overseas trade—in contrast with the vast size of our coastwise fleet—has been considered.

What, then, of the future? Are there any new or old national policies that can be invoked to give the United States the place to which it is entitled on the ocean? For one thing, an experiment in free ships is now being tried. From the year 1790 to 1912 American registry as a general rule had been denied to all ships that were not of American construction. The purpose of this policy was to shield and encourage American shipyards, so valuable to the national defence. The motive was good, but the method was ineffective for the large development of a merchant marine. It was as if there had been a prohibitory tariff duty upon the machinery of textile or other mills, with no duty on or protection for the products of that machinery or industry

Ships are the machinery, or the tools, of the shipowner's trade. He will buy and use that machinery, or those tools, only if he can conduct a profitable business. Otherwise he will not be able to purchase and employ them, and a sheer prohibition on their importation from other lands will be a matter of mere academic interest.

So it has been with prohibition of import, or American registry, of foreign-built vessels. Of itself and by itself, it has been impotent to make American shipyards prosperous or to create a great American merchant marine in overseas trade—which is primarily a problem of profitable shipowning or operation. There has been a great deal of confused thinking and writing on this subject, and even now the assertion is often made by some public man or newspaper that American ocean shipping has been "protected to death"—whereas it has never in our time, been protected at all. Neither a protectionist policy nor a free trade policy has been consistently applied and tried, and the result has been precisely what might have been anticipated.

In the beginning—as has been shown in a previous article—the national policy was a wholly sane and consistent one. That was the policy of Washington, Jefferson, and Madison. Under their laws, that proved so wonderfully successful, American registry was given only to American-built ships, but preference in employment was absolutely guaranteed to those ships by a differential customs duty of 10 per cent on their import cargoes—by an even greater differential in the rich East India trade—and by heavily discriminating tonnage taxes. That is, both shipbuilding and shipowning were powerfully aided and encouraged by the Government. Later, when the preferential policy and the modern mail subsidies were swept away and ocean shipowning was left a completely unprotected industry, the prohibitive protection on shipbuilding remained. That was only one half of the "policy of the fathers," and the less vital half, and, of course, it was utterly ineffective. It could not possibly have been otherwise.

There was, however, this important qualification, that the coastwise trade remained wholly reserved to American ships, and finally American ships were built only for this coastwise commerce. This part of the original historic policy has never until this year been seriously attacked. It was assailed in a very formidable way by a proposal, in connection with the war emergency shipping legislation of last August, to admit foreign-built vessels to the coastwise trade, but the plan was overwhelmingly defeated in the Senate, two to one, after a vigorous debate, which if continued longer, might have made the defeat well-nigh unanimous. American public opinion of to-day apparently approves as strongly as ever the reserving of our huge domestic commerce to carriers launched from American shipyards, as a sure expedient to maintain the shipbuilding art in America, so that there may always be machinery and men for the construction and upkeep of our warships.

The first departure from the national policy of granting the American flag only to American-built ships was taken in an unexpected amendment to the Panama Canal Act of August 24th, 1912. Shipbuilding for the foreign trade had ceased in the United States, except for the few subsidized mail lines. It was argued, and accepted, that our shipyards would not be hurt by an offer of American registry to foreign-built American-owned ships for foreign commerce. But this new departure, to the surprise of its political friends, but not to the surprise of experienced shipowners and merchants, proved absolutely futile. Not one foreign-built ship of any kind received or applied for the American flag. The cost of operation was the obvious explanation. It would have been increased in the case of any ship brought beneath American laws, and naturalization would have involved the instant loss of foreign subsidies wherever these were granted.

Thus the situation stood at the outbreak of the great war in Europe. That war created a new and powerful motive for the possession of an American fleet in ocean trade, for Great Britain and Germany were our chief ocean carriers, and for a time our export and import commerce was gravely disorganized. The war also created a new motive for the bringing under the American flag of a great part of the shipping—estimated at 1,000,000 tons—in which American capital was interested on the registry of foreign governments. The United States, as the one great and powerful neutral, was in a position to give the most secure protection to its own merchant ships—an advantage vividly reflected in preferential rates of war insurance, which in many trades for the time being more than offset any enhanced cost of American operation.

A new free registry law, approved August 18th, 1914, broadened the free ship section of the Panama Canal Act by admitting foreign-built vessels for use in the foreign trade, without distinction of age. The Panama Act had a restriction that ships should be "not more than five years old at the time they apply for registry." Moreover, because shipowners desired to retain faithful foreign officers long in their employ, and there was some question whether enough Americans would be available, the President was authorized in the new act to suspend the requirement that the master and all deck and engineer officers in charge of a watch should be American citizens. As an additional inducement, the President was authorized also to exempt foreign-built vessels from compliance with American measurement and inspection laws.

This somewhat extraordinary legislation, which actually gives foreign-built vessels an important preference over American-built vessels in the overseas trade of the United States, has, together with the war itself, brought under the American flag at this writing 36 foreign-built vessels of 135,895 gross tons—a valuable reinforcement to the 1,027,776 tons of American shipping already registered for foreign commerce, but a result that falls far short of any adequate and enduring solution of the problem of a great American marine. With a very few exceptions the ships thus naturalized were American-owned before the war began. There has been no sign of any substantial American purchase of foreign-built ships now controlled by subjects or citizens of foreign governments—a fact which, perhaps, is not surprising in view of the declaration of London and of the emphatic protests of the British, French, and Russian ambassadors that the transfer of idle German ships to the American flag would be held invalid, and that the craft would be seized as lawful prizes of war.

Another indication that the new free registry law, standing by itself, will prove of only partial and fleeting benefit is that the foreign officers of some of these naturalized vessels have promptly claimed and received the wage rate of American officers. On one steamer of the United States Steel Corporation this has increased the cost of the British engine room force from $282 a month to $420. A similar advance in the pay of the master and deck officers is apparently inevitable. Except on the few subsidized mail liners, there is now no requirement that the crews of American merchant ships below the watch officers in rank shall be American citizens. An entirely foreign complement of sailors, firemen, etc., can be employed. And yet the wage scale of American ships in American ports is from 30 to 50 per cent higher than the wage scale of ships of foreign register. Wages on shipboard are determined, not by the "antiquated" navigation laws, much berated and little understood, but by natural economic law, not to be repealed or changed by act of Congress—by the general rate of wages and standards of living prevalent on shore in the United States—exactly as shipboard wages are determined everywhere else in the whole world.

That the free registry law for this and other causes will fail of full and permanent effect is seemingly recognized by its chief authors and champions, for President Wilson and some of his party leaders have been pressing another bill for the Government control and operation of steamship companies in which private investors shall be allowed to have a minority interest. This is plainly regarded as a very doubtful expedient by the informed maritime opinion of America, which has quite unitedly protested against it as certain to discourage private initiative, and to delay indefinitely the creation of a real merchant fleet.

To the present trial of a free registry law for foreign trade there can be no objection. It is the law of the land, and the actual value of the ship policy can now be tested under favoring conditions at a time when no more positive legislation can be secured from Congress. To the free registry law there should immediately be added a frank and searching examination of the navigation laws, and no new laws or regulations that may cramp American shipowning should be enacted at the present time. American methods—not laws—of measurement can be improved. Some American inspection rules, not enforced elsewhere, are unnecessarily rigid. There is no reason why American ships should be compelled to have more officers and men than foreign ships. It was exactly the contrary when the Stars and Stripes flew everywhere victorious. An investigation, modernizing and liberalizing the whole system of navigation enactments should certainly be had at once by the best board or commission of expert authority that can be summoned from the entire nation.

But this also, like the free registry law, will not alone suffice. The British merchant shipping acts, the result of the largest and most successful maritime experience, may be adopted word for word by the American Congress, and yet the heart of this question of American ocean shipping will not be reached.

The real heart of the problem lies in these three facts: (1) that the ocean shipping business of the world, including nine tenths of our own import and export business, is now monopolized by the shipowners of foreign governments, who are determined to retain it, in order to keep their own commerce as great and and our commerce as small as possible—controlling our own delivery wagons they know that they can do it; (2) that nearly fifty million dollars in subsidies and bounties of various kinds are annually bestowed upon their ocean shipping by Europe and Japan—and where no subsidies are paid other and equally effective national aid and encouragement are given; and (3) that, as in our land industries, protected by the tariff or natural conditions, American wages and standards of living are the highest in the world, so they have been, are and in all probability will remain upon the seas.

American capital, even with free ships and equalized navigation laws, will not go into and remain in ocean shipowning under the American flag unless it can earn dividends at least equal to those now earned under foreign colors. The maritime condition now confronting the American people is strikingly like that which faced Washington, Jefferson, and Madison in 1789. They met it, with vigor, courage, and patriotism, in a series of enactments that gave preference in employment to American ships, in the carrying of American commerce. Either this must be done again, as was actually proposed, but nullified and abandoned in the new tariff law of the present administration, or a comprehensive system of subsidies or subventions will have to be adopted, or some other but equivalent form of national aid and encouragement will have to be discovered and applied.

Neither the war itself, nor the free registry act nor an overhauling of the navigation laws will give the American people the ocean fleet which is their dream and birthright. There must be new, strong, positive legislation, framed, enacted, and enforced by men who are as ready, when they believe they are right, to hoist the flag and go ahead as were the fathers of the republic.

Compressed Carbon Dioxide for Small Arms

AIR guns are awkward to load and have but little penetrating power. If it were not for this they would probably have found somewhat extensive application for sporting purposes. There has been recently placed upon the market a gun in which compressed carbon dioxide is used as the propelling agent. The carbon dioxide, according to a note in *Prometheus*, is contained in a small interchangeable case, holding sufficient for from 100 to 800 shots, and lodged in the gun. Upon pulling the trigger the requisite amount of the gas is admitted into the cup and propels the shot from the barrel. With small shot the gun has a range of about 80 feet; with bullets a range of about 180 feet. The number of shots which can be fired depends, of course, on the bore of the gun. About 100 shots can be fired with small shot, 150 with a bullet of number 8, 300 with a bullet size 6, and 800 with a bullet size 4.

[illegible] pupils, [illegible] equipped to care for all children [illegible] under the high school may have the use of the gymnasium in their turn.

It might seem that the use of electricity for heating a building of this size might be a complicated and intricate affair, but this is not the case, and one wonders that the world has waited so long to make this use of electricity, which is feasible in any part of the country where cheap hydro-electric power is available, and especially if it could be used in competition with high-priced coal as is the case at Rupert.

Use is made of the usual system of hot-air flues, pipes, plenum chamber and ventilating fan, but the steam coils or coal furnace usually employed for heating the air to be driven into the various rooms is replaced by a battery of electric heating elements similar to those used in electric baking ovens. This heating equipment is installed below the front entrance to the building and consists of twenty-two 18-kilowatt units connected up in pairs, each pair with separate switch control from the switchboard in the principal's office. The transformer room adjoins the furnace room, and is of absolutely fireproof construction ventilated by outside windows with steel casings and frames. The transformer is fed from the 4,000-volt, four-wire distributing system of the Rupert Electric Company by underground cable. It is a 400-kilowatt capacity, three-phase, self-cooling type filled with oil. Low-tension leads are brought out for full capacity at either 440 or 220 volts. An emergency switch in the principal's office may be used to open the 4,000-volt circuit and cut the power entirely out of the building. The switchboard in this office, with its eleven switches, anyone of which may be used to throw its unit on either 440 or 220 volts, and thus use either 9 or 36 kilowatts, gives opportunity to use any amount of current from nothing to about 400 kilowatts in steps of 9 or any multiple thereof. While dampers are provided in the pipes leading to each room, the amount of air provided for each room has been so accurately determined that it is seldom necessary to use them, the temperature throughout the building being practically uniform and under the control of the switchboard. The fresh air is drawn down the cold air shafts from the top of the front entrance, heated by being drawn through the electrically heated units, and forced into the plenum chamber where it is moistened and forced out to the various rooms through the usual pipes and flues. The heated air enters the rooms near the top and the foul air is removed from the room through brick flues to the roof of the building.

The building has a cubical content of 300,000 cubic feet. The fan supplies 20,000 cubic feet per minute and can, therefore, replace all the air in the building in fifteen minutes. At night the building is kept warm without the fan by switching the heaters to low voltage, cutting off the supply of cold air, and opening the doors of the rooms into the corridors. In the morning the fan is started to equalize the temperature, and when up to 70 degrees the fresh air damper is again opened.

The system was put to work in January, with a new, incomplete, and thoroughly cold building, with bitterly cold and windy weather, and yet proved that it could heat and ventilate the building with less than two thirds of the maximum capacity of the plant. Current for heating purposes is furnished at a flat rate of $1 per kilowatt per month, maximum amount used during the winter months to be paid for at least four months, making a minimum charge of $4 per kilowatt for the season. On this basis it was figured that the use of current for heating purposes would cost $1,720 per year, but experiment proves that this may be cut to $1,800 or less. Coal alone would have cost $1,000 per year, and would have required the services of a fireman, whose wages are saved by the use of electricity. As the cost of installation was less than of any other system of heat it will be seen that the use of electricity is proven to be an actual economy in the Rupert building, to say nothing of the saving of space and the saving from the annoyance of smoke, dust, and other disadvantages of any system using coal as a fuel. Under this system the heating of the building for use at night may be accomplished with no extra expense except current used for driving the fan. As the building is to be a community center and used to the fullest extent this is an important matter.

The building is electrically lighted throughout, so that any or all rooms may be used at night, the lighting of auditorium, stage, gymnasium, lecture and other science rooms being exceptionally fine. Electricity is used for cooking; for heating water for the cooking rooms, the shower baths, the various lavatories throughout the building, and for the science rooms, for ironing, for power, for evaporation purposes in the science rooms, for distilling water, for the stereopticon in the auditorium and lecture room, for experimental purposes, and if the odors from cooking ever become offensive an electric ozonator will be used to destroy the odors. Current for all these purposes are on a graduated metered basis and vary with the use to which the current is put.

Radio-telegraphy at the Eiffel Tower

(Concluded from page 321.)

in itself makes this station one of great importance.

As is to be expected in an experimental plant, several distinct transmitters and a variety of receiving instruments are installed. The largest transmitter is one of 1,000 cycles, 150 kilowatts power, which has only recently been put in place, and which operates according to the plan developed by Bethenod and the Société Française Radio-electrique for developing a single frequency of radiation. By such purity of emission, in combination with the high musical spark tone given by the 1,000 cycle alternator, it is possible to take advantage of sharp tuning for selection of desired messages, and, by the ear alone, to distinguish the singing spark signals through the rumbling noises of atmospheric disturbances which would prevent reception from a lower-toned spark transmitter The spark frequency can be made as high as 2,000 per second, but is usually about one third this, so as to allow the sending condensers to charge at a higher pressure by making use of resonance in the power circuits. Fig 1 shows the motor, generator, and controlling switchboard for the large outfit, and Fig 2 gives a view of the operating keys which are used for making the dots and dashes of Morse signals on the various transmitters. In this photograph there can also be seen portions of the switchboards and auxiliary apparatus which are used to make the adjustments necessary in sending.

The old high power transmitter is one of from 60 to 80 kilowatts power, which draws its 220-volt energy from the public mains at 42 cycles. By variable iron-core coils the power circuit is made resonant, and the spark is ordinarily allowed to pass at only each third alternation, or about twenty-eight times per second. In marked contrast to the 1,000-cycle sender, this outfit does not emit signals in musical tones, but in a sort of rattling sound which it has been found almost impossible to interpret when the similar noises from atmospheric electrical discharges are at all loud.

A tremendous battery of glass jar condensers is used with the low-frequency transmitter, giving a total effective capacity quoted as about seven tenths of one microfarad. The spark takes place between the end of a brass tube (through which the air is forced by a blower) and a flat copper plate, as shown in Fig. 4, a type of spark gap which has shown extended use in France. The large condenser makes necessary special provisions for handling high values of high-frequency current, and so the inductance coil of the large transmitter is bent from copper tubing about ten centimeters (nearly four inches) in diameter. Likewise, the large



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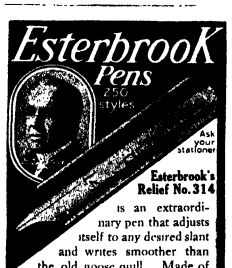
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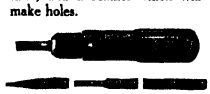
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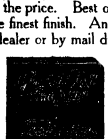
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condenser forces the station to operate on long wave-lengths, and even then so little self-inductance in the circuit; for a 2,150-meter wave-length less than two turns of coil are placed in the condenser circuit.

The Eiffel station has also been equipped with a 10-kilowatt 42-cycle transmitter, for signaling moderately short distances, and a 22-kilowatt 1,000-cycle set. It is this last named outfit which is shown partially by Fig. 4. A rotary gap has also been provided, and is shown in Fig. 3. This gap may be substituted for one of the tube-and-plate gaps, but is not an interrupter (such as often is used in American stations), since the sparking distance remains constant as the rotating electrode spins. The only function of the motion is to keep the gap cool by spreading successive sparks out over different parts of the stationary electrode. This cooling is effected, in the tube-and-plate gaps, by the air blast from the blower shown in Fig. 5. The power transformer (at the left), condenser tubes stacked in racks, and the inductance coil of the 60-20 kilowatt set can also be seen in this photograph.

The Paris station has become widely known through the long-distance tests which it has made. Communication with Algeria and Tunis is understood to be regular, and within the past few months there was completed a series of important experiments in time and longitude differences between the Eiffel station and the United States naval high-powered plant at Arlington, Va., 3,700 miles away. The Eiffel station was selected by the recent International Conference at Paris as the center of a group of powerful equipments for an international time service, and now sends exactly regulated signals at 10 in the morning and at midnight each day. These serve to fix Greenwich time to the fraction of a second for any listening wireless station within range, and thus make it possible for the masters of ships at sea to secure standard time for making astronomical observations of their positions. Meteorological telegrams are sent broadcast at fixed hours each day, and the advance weather reports and storm warnings prove of value not only to those at sea, but to the farmers who have arranged for their reception at convenient points inland. In this way the Eiffel tower station is proving of immediate use to the people of France and the surrounding countries, while, in addition, the importance of its potential value in case of war, and the excellent work it is doing toward ultimate opening of the world-embracing radio-telegraph chain, are held in the highest esteem.

Strategic Moves of the War

(Concluded from page 322.)

their right flank extended 100 miles to the southwest and threatened Ossowetz, where the railroad southeast from Lyck crosses the Narew River. Their plan was to push this southern move so as to get in behind the Russian army at Warsaw. Then the advance of the German army from western Poland was to cause a combined pressure on the Russians that would force them to let up in their attacks on the Austrians in order to save their own army to the north.

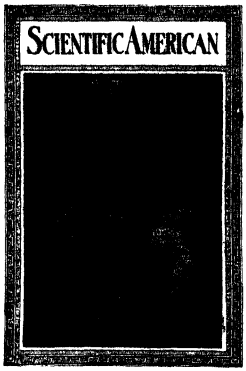
To offset this move the Russians concentrated forces at Grodno and moved northwest against the center of the East Prussian army. The mud hampered the movements of both armies, but the Russians, being better equipped for getting artillery and wagons over soft roads, were able to make better use of their troops, and especially were able to move their artillery to vantage points. The tactics of frontal attacks are almost entirely dependent on the protection of artillery fire. So great is the supply of ammunition furnished that the most inaccurate marksmen could drive back an attack of unsupported infantry. The rapid-firing field guns by sprinkling the advancing columns with a hail of shrapnel, can by their own fire alone stop the charge of any unconcealed troops.

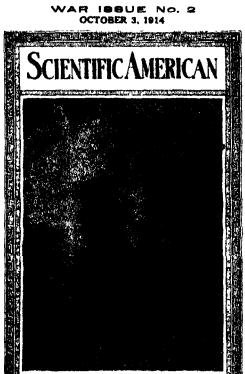
The German artillery is mostly built for service where the ground is hard

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the Russians by pressing through deep mud. The automobile trucks on which the army depends for its supply service are still too small for traversing soft roads and fields. The Russian field guns, like those of the United States, are higher set, due to their development through service in districts where good roads are few and far between. Consequently, the prolonged rainy weather of the last two weeks in this battle zone has fought on the side of the Russians. They have been able to get their artillery up into action, while that of the Germans has been to some extent stuck in the mud.

This local fire superiority enabled the Russians to bring a shrapnel fire to bear on the German line that forced the defenders to stay under cover. In many places the saturated soil forbade the construction of the splinter proofs, or roofed-over pits, necessary for protection against the fall of the shrapnel bullets. So when the Russian artillery secured the dominance, the Germans had no choice but to retire.

It is these tactics that enabled the Russians to break through the center of the German line at Augustowo on October 1st. The retreat of the center endangered the flanks so that they too had to fall back. The Russian success has been further pursued until the Germans have been forced back to a line through Lyck, 10 miles west of the border.

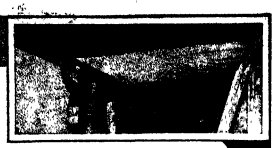
This strategic gain of the Russians relieves pressure on their central army in Poland and allows them to proceed with the pushing forward of troops through this district to attack the Germans in western Poland. In order to permit their central army to become fully organized before coming into contact with the Germans, the Russians had to concentrate their forces east of Warsaw. An attempt to protect the Polish border would have exposed the first Russian forces in the field to being overwhelmed and captured by the larger armies that Germany could at first move to the front, due to her better rail facilities.

In Galicia the stiffening of the Austrian line along the Donajec River, 50 miles east of Cracow, has held back the Russians for a week. The further advance of the general Russian line in the campaign against Germany depends upon clearing one of the flanks. It is for this reason that Russia is concentrating her efforts on the two flanks. As soon as one of them gives away, they will be free to push forward without exposing their lines to an attack from both flanks.

The invasion of Hungary by Cossack divisions is in line with Russia's general conduct of campaigns, but is not an immediate part of the general campaign in Poland and Silesia. Just as Gourko's cavalry was rushed forward to the Balkan passes in the war of 1878 against Turkey, to prevent Turkish reinforcement of the garrison of Plevna, so are the Cossacks now being poured into Hungary to divert Austrian troops from the Galician field. This invasion gives Russia a chance to make use of her large numbers of mounted troops that cannot be used to best advantage in the main battles. It also throws the burden of the war upon additional provinces of her enemy.

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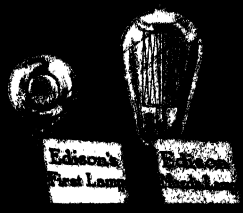
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"The first time I met Edison was in 1893, at the International Electrical Congress at Chicago. Mr. Rudolf Eickemeyer introduced me to him, and Edison, jokingly pointing at me, said "pure theory," pointing at Eickemeyer, "theory and practice" and at himself, "pure practice." This is the attitude Edison has always taken, declaring himself a mere practical man, and the newspaper men have expanded on this and so created the popular belief that Edison does not know anything about theory and science, but merely experiments and tries anything he or anybody else can think of. There is nothing more untrue than this. It is true Edison never went to any college—but he knows more about the subjects taught in colleges than most college men. From my experience I consider Edison today as the man best informed in all fields of human knowledge."

CHARLES P. STEINMETZ

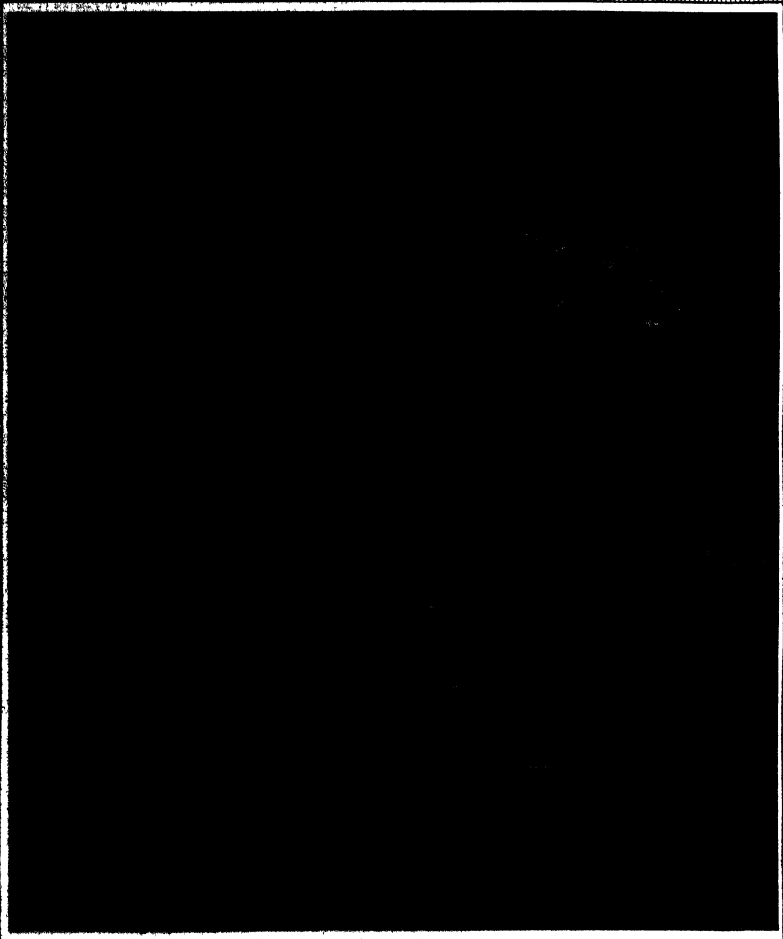
"His work, and particularly the invention of the electric incandescent lamp, must forever remain an inspiration to mankind. The long weeks and months of tedious experimenting, the dauntless patience that bravely struggled on after each momentary defeat, and the resourcefulness that turned even failure to account have perhaps never been equalled and certainly never surpassed in the history of human achievement.

No wonder that this man enriched his time with one of its most precious inventions—the Edison lamp—with a form of illumination so wonderfully cheap and efficient that it has enabled the teacher and the printer to extend the influence of civilization where it has never been felt before."

WALDEMAR KAEMPFFERT

SCIENTIFIC AMERICAN

16.NOV.1914



GIANT FIGURE OF MERCURY FOR THE GRAND CENTRAL TERMINAL GROUP —[See page 339]

Making War Photographs from Aeroplanes
Letters from the Firing Line

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

An Inconvenience, Not a Disaster

THE blocking of the Panama Canal by a slide in the Culebra cut is a serious inconvenience, and that is all. In no sense can it be considered a disaster. Colonel Goethals and his corps of engineers have recognized that a certain amount of sliding of the banks of the canal might occur through a considerable period of time after the canal was opened, and the huge dipper dredges, now at work in the cut, were designed to remove these slides. The present slide is serious, it is true, for the channel is entirely filled; but the material is broken rock, easily removable, and the delay until the channel is again opened will not be great.

Such movements are the inevitable result of cutting down several feet into the heterogeneous mass of silted and igneous deposits of which the Panama Isthmus is formed. The material of the cut must find its angle of slope or repose throughout the whole nine miles of the great cut. Every slide brings the inevitable period of quiescence nearer; it cannot be far removed.

The Passing of Permanent Field Fortifications

THE astounding ease with which the fortifications of Liège, Namur, and now of Antwerp, were reduced by the attack of modern siege artillery has brought home the conviction to military men that the day of the defense of frontiers by great forts, such as those which line the French frontier, has passed, probably never to return. There will be division of opinion on this subject, of course; but the comment of one of our army engineers, when he saw the illustrations of the wreck of Belgian forts which are found on page 338 of this issue, "That means that there is nothing left but the mobile field army," seems to us to be very much to the point.

The indirect-fire siege gun of the Germans has obtained the same complete mastery of fortifications, that the direct-fire, high-velocity rifle of the battleship and armored fortifications has obtained over armor plate.

When Germany declared war on France her General Staff knew that they were in possession of guns (11-inch or 16-inch, it matters little which) that were capable of hitting their way resistlessly through the most modern and powerful forts to be found either on the French frontier or surrounding the city of Paris.

It was well understood that if a smashing offensive carried the German troops close enough to the Paris forts (say within three or four miles) to enable the huge German siege pieces to be emplaced in the rear of the troops and rain down their high-explosive shells upon the French works, it would be possible quickly to cut a pathway through to the city by which the German army could advance and take possession, without investing the city with half a million troops.

Although it is our belief that most of the work of reducing the Belgian and French fortifications has been done by the 11-inch mobile field howitzer, the persistence with which mention is made of a 16-inch siege gun, coupled with information given to us by a correspondent who has recently returned from the French lines, and claims to have seen such pieces in action, inclines us to the belief that a new and special type of gun, based on the principles of the so-called torpedo gun of fifteen to twenty years ago, is now in successful use by the Germans. This gun is probably of an entirely different type, both as to barrel and projectile, from the 12-inch mortar used in our land fortifications. The latter is simply a shortened, direct-fire 12-inch rifle. It uses high pressures in the powder chamber, has a heavy inner tube and heavy reinforcement, and fires a thick-walled shell of great weight (1,000 pounds), capable of piercing armor.

The 16-inch gun is probably a successful development of the Gathmann idea of firing a comparatively thin-walled shell, containing a very large high-explosive filler. Gathmann's idea was that, if a large amount of gun-cotton could be detonated against armor plate, it would smash the plate to fragments. Congress appropriated the money, an 18-inch gun was built, and the gun was tested at Sandy Hook in competition with an army 12-inch gun. The 18-inch shell, containing 630 pounds of explosive, detonated on the plate and left scarcely a mark on its surface. The 12-inch shell, carrying only 60 pounds of Maximite explosive, passed through the plate, and bursting in the rear, tore the heavy steel backing into fragments.

The army officers reported against the gun as being useless for direct attack against heavy armor, which can be penetrated only by heavy, armor-piercing shells, carrying a moderate bursting charge, with walls thick enough to hold the shell intact, in its passage through the plate, and cause the detonation to take place within the ship.

But although the thin-walled shell, with its large cavity filled with an enormous charge, is useless for direct, or horizontal, attack of armor, it is an ideal projectile for vertical attack upon the comparatively thin top surfaces of the Gruson turrets, and the easily penetrable masonry surrounding the turrets. A 16-inch shell of a modified "torpedo" type, with a large cavity, carrying an enormous charge of explosive, could be formed with sufficient wall thickness to carry it, intact, deep into the mass of masonry surrounding and supporting a Gruson turret, or any modern type of mount. The detonation of one such shell provided with a delayed action fuse, within the massive concrete of the heaviest fort in existence, would account for even such a complete wreck as is shown in the illustrations above referred to.

Now although, as we showed last week, it would be impossible, because of the enormous weights involved, to produce a *mobile* 16-inch gun of the standard type, such as the *fixed* mortars in use in our own coast fortifications, it would be possible to build what might be called a semi-mobile, 16-inch piece for firing torpedo shells of the kind above referred to. Our 12-inch mortar, with its high powder pressure and (for a mortar) high velocity, can throw a shell to an extreme range of eleven miles. To do this the gun has to have great thickness and weight of barrel. But to throw its shell for, say, six or seven miles, the 16-inch gun requires only low powder pressure and a correspondingly less thickness of gun barrel. This brings the weight of the separate parts, barrel, sleeve, carriage, turntable, down to a point which renders them transportable on special carriages over the highways. The gun is not in any sense a field howitzer, for it is necessary to build those concrete foundations of which so much has been said in correspondence from the front, to provide an unyielding base for the turntable or other traversing device of the gun mount.

That the gun, light though it is for so great a caliber, is not a mobile field howitzer, is proved by the fact that a sudden gain by the allied line near Soissons, as reported officially, resulted recently in the capture of two of these guns, which were left behind on their concrete platforms. Had they been mounted like the 11-inch gun recently illustrated in this journal, they would have been drawn to the rear at the first signs of failure of the infantry to hold the enemy.

Rain After Battles

"IT is one of the extraordinary things of warfare," says a recent writer in *Pearson's Weekly* (London), "that a big battle invariably produces rain. We could hardly have a better example than that recorded in 1588, when England was threatened by the great Spanish Armada. After its encounter with our own fleet it was, as we all know, struck by a heavy storm, which completed the work of our gallant seamen."

Once in the early Stone Age somebody remarked to somebody else that rain frequently occurred after battles. The author of this casual statement was probably not a psychologist, else his conscience would have smitten him for having set afoot in the world the germ of a particularly fatuous fallacy. The evolution of the idea was probably complete long before the Age of Bronze. Big battles are often followed by rain. Big battles often *produce* rain. Big battles *invariably* produce rain. Even the modern penny-a-liner cannot improve on the last statement. The myth is fixed—crystallized—and probably imperishable.

Had we enjoyed the privilege of personal acquaintance with the Neanderthal gentleman just mentioned we should have courteously entreated him to start another ball rolling down the ages, to wit, "A big sneeze is often followed by rain." The infinitesimal increase in the humidity of the air occasioned by a sneeze is a simple and obvious fact; whereas the infinitesimal amount of water vapor produced by the explosion of a few tons of ammunition can be hunted down only by an excursion into the fields of chemistry.

Since, however, we must put up with the myth in its present form, let us see how it happens that rain has so often followed battles as to suggest to uncritical people that there was a physical relation between the one and the other.

First of all, no such relation exists. Rain is the result of the active condensation of moisture in the atmosphere, and this is purely a question of humidity and temperature. If the humidity be sufficiently increased, or the temperature sufficiently lowered, condensation is inevitable—provided certain nuclei of condensation (dust particles or molecules of hygroscopic gases) be present; and, outside of the laboratory, they always *are* present.

Now, it is conceivable that a warring army might produce a local rainstorm by setting fire to a great city. If the air be rather moist, a large conflagration invariably builds up great cumulus clouds above it. The heated air rises and cools by expansion, just as it does from the sun-heated earth on a summer day, and condensation results. Under favorable conditions a very big fire might cause a smart shower, or even a thunderstorm, though usually the process goes no further than to form clouds.

A battle, however, cannot be supposed to have any appreciable effect upon either the temperature or the humidity of the air. Two explanations of the alleged production of rain by battles have been offered; one nonsensical, and the other pseudo-scientific. The nonsensical explanation is the popular one, viz., that the condensation of moisture is promoted by the concussion due to cannonading, or that the drops already condensed and constituting the clouds are jostled together by the same process, with the result that they coalesce and fall as rain. As was once pointed out by Prof. Newcomb, the effect of a violent explosion upon a body of moist air a quarter of a mile away is exactly the same as that of the clapping of one's hands upon the moist air of the room in which the experiment is performed, i. e., absolutely *nil*. Or again, if we stand in the steam escaping from a kettle and clap our hands we shall not produce a shower, though we jostle the water-drops just as much as the explosion does at a distance of a quarter of a mile.

The pseudo-scientific explanation is that the gases and smoke produced by explosions increase condensation by increasing the number of "nuclei" in the atmosphere. The nucleation of the atmosphere, as affected by ordinary dustiness, by hygroscopic gases, by radio-active discharges, by ultra-violet light, and what not, is still an obscure subject. An outstanding result of recent investigations, however, appears to be this: The lower atmosphere normally contains more than the minimum number of nuclei necessary for the process of condensation, and this process cannot be made more active by a mere increase in the number. Thus various and abundant nuclei, in the form of gases and smoke, are given off to the atmosphere by great manufacturing centers, yet these places do not have a heavier rainfall than the surrounding open country. Pittsburgh, for example, is one of the dryest places in Pennsylvania. The suggestion that explosions may produce rain by furnishing nuclei to the atmosphere is, in fact, a mere speculation, and probably could be easily refuted by laboratory experiments.

Now if we examine the history of battles and the history of weather we shall find that rain does not always follow great battles, though it frequently does so, and for two very obvious reasons. If, for example, we consult the meteorological records of northern France, where some of the greatest battles in history have recently occurred, we learn that, under normal conditions, rain may be expected in that region about every other day, on an average. Thus at Sèvres, ten miles from Paris, the records from 1898 to 1901 show an average of 157 rainy days per annum. These rainy days did not, of course, alternate regularly with rainless days; but there were generally several rainy spells each month. It is, therefore, evident that the probability of rain within, say, twenty-four hours after a battle, or a dog-fight, is rather high, owing to the ordinary operations of Nature.

The probability of rain after, or during, a battle is, however, materially increased by the fact that the intervals of fair weather between successive rain-spells are normally utilized by commanders in the movements of troops which precede a battle. These movements can generally be effected only in dry weather, and they may require several days. By the time all the dispositions have been made the barometric conditions have changed; the dry "high" has passed on its regular way to the eastward, and the edge of a rain-bringing "low" has entered the *terrain*. Thus a downpour is likely to occur soon after the engagement is well begun; but its cause must be sought in the interplay of forces over which mankind has no control.

Science

To Chemically Cause Paper to Become Transparent Use the following solution on the paper: White wax, two ounces; absolute alcohol, fifteen ounces; and ether, one ounce. The solution will be muddy at first, but after a few minutes pour off the clear solution, which is the one to save and use. (Contributed by Loren Ward, Des Moines, Iowa.)

Darkness Before Dawn.—It is proverbial that "the darkest hour precedes the dawn." Mr. W. F. Denning, the English authority on meteors, has recently called attention to the literal accuracy of this proverb, as established by his own observations on thousands of nights. He says: "Before dawn a greater darkness seems to drop down like a mantle upon the immediate surroundings. Objects which were plainly observable during the previous hours of the night are blotted out, and a nervous feeling is sometimes induced by the dense opacity of the air." He claims to have noticed this phenomenon when the subject was far from his thoughts, so that it could not have been purely subjective. He is unable to state the exact interval before sunrise when the remarkable darkness comes on, nor whether it is common to each season and sky conditions.

Ungava, the immense territory which was added to the province of Quebec in 1912, is the subject of a report recently issued by the Canadian Department of Colonization, Mines, and Fisheries, and abstracted at length in a current United States consular report. The annexation of Ungava increased the area of Quebec from 351,878 to 703,635 square miles, making it by far the largest province of Canada. The territory in question embraces the upper half of the Labrador Peninsula, aside from the portion of the latter belonging to Labrador proper. It is a huge plateau, with innumerable lakes (constituting about one fourth of its total area) and a network of streams, which facilitates travel and is capable of supplying unlimited water-power. On the other hand the climate is, over most of the territory, too rigorous for agriculture, nor is there much prospect for grazing. The forests are of some value, and there are supposed to be important iron deposits. The lakes and rivers yield an inexhaustible supply of fish. The value of the Hudson Bay fisheries is still unknown.

The Lowest Organ Note.—A most remarkable accomplishment in the acoustics of music as told by *Science Conspectus*, is the installation of a 128-foot stop in an organ in Lowell, Mass., which produces a tone an octave lower than has ever been known before, and which is indicated musically as CCCCCC. To understand what this means it may be said that a 32-foot pipe vibrates sixteen times a second at its lowest note (CCCC), and this is very near the point below which vibrations cease to form a continuous sound, while a 128-foot pipe vibrates but four times a second when producing its lowest sound. It was found, however, that a group of pipes giving overtones could be arranged to produce, when sounded together, a synthetic tone, and by this means stops producing the effect of a 64-foot pipe have been built without requiring the use of a pipe of that length; and now, in the same way, this monster 128-foot stop has appeared, which is described as "a mighty atmospheric throb of most awesome majesty," indeed it would seem that its tones must be rather felt than heard.

Barometric Pressure and Mine Explosions.—Just what relations, if any, exist between barometric conditions and explosions in coal mines are still unknown, though the matter has been the subject of much discussion and investigation. In England certain newspapers and other unofficial agencies have for many years issued "colliery warnings," generally based on the assumption that a rapid fall in barometric pressure liberates explosive gas from fissures and cavities in the mines, and thus increases the danger of an explosion. Other ways in which the pressure of the atmosphere may be connected with explosions have, however, been suggested. Thus it is possible that high pressure may be more effective than low pressure, by causing slight dislocations of the strata. Again, exceptional dryness of the atmosphere, such as is especially associated with anticyclonic weather, may increase the likelihood of dust explosions. The present attitude of the United States Bureau of Mines on this subject is set forth in recent correspondence with the Weather Bureau. The former bureau does not believe that any particular relation can be established between explosions of fire damp and low barometric conditions. The accumulation of fire damp in old workings is not usual in the mines of this country, while the gas encountered in active workings almost always issues at a pressure far higher than atmospheric —even at several times atmospheric pressure—so that the ordinary fluctuations of the barometer could have no influence on its issuance. In view of the obscurity in which this subject is enshrouded, the Royal Commission on Explosions in Mines deprecated the issue of colliery warnings by the British Meteorological Office.

Automobile

Motor Trucks Must Have Mirrors.—Beginning with January 1st, 1915, all motor trucks in New Jersey must be fitted with mirrors enabling the driver to see the road in back of the truck. The rule was made necessary by the protected position of the driver, who is unable to see behind and to realize when another vehicle desires to pass from the rear. The noise of his own motor drowns the warning signal of the passing car

New British Non-skid Tire.—A non-skid automobile tire of unusual design is being introduced by the Sirdar Rubber Company of London, England. The tire has a zig-zag line deeply cut into the tread, in which metallic studs are set so that their tops are flush with the tread. The tire is said to be very resilient, and yet as much a "non-skid" as if it were fitted with separate steel studded cover.

Owing to the Total Cessation of Business of Continental automobile manufacturers in England it is anticipated that American makers will experience a decided increase in demand from this quarter; and this will in all probability prove to be a most advantageous opportunity for the builders of electric vehicles, especially in the classes of commercial and municipal vehicles, for which the English representatives of American companies believe there is a very promising field.

New Laminated Tire Fabric.—A new tire fabric is to be put on the market shortly by one of the big Akron tire companies. This fabric is termed a "laminated cohesive interwoven fabric" and was invented recently by L. A. Subers of Cleveland, O. The material differs from the usual tire fabric in that it has no cross weave of any kind, the extraordinary strength of the material depending on the impregnation of the yarn elements with liquid rubber. Inner strains are thus avoided.

Direct Air Cooling of Automobile Engines has always been recognized as ideal, as it does away entirely with radiators, pumps and all the attachments necessary in a system of water cooling; but on account of difficulties encountered in the early days, when motors were crude and the principles were not as well understood, most designers adopted water cooled motors. Still, a few builders persisted in the study of air cooling, and that their efforts have not been in vain is shown by some test runs organized by one of the air cooled machines, when a hundred miles of more than ordinarily hard going was covered entirely on the low gear, which is a fairly satisfactory proof of the practicability of air cooling.

A Crucial Test for Alcohol Fuel.—The unquestioned shortage of gasoline in Germany probably will lead to the universal adoption of denatured alcohol for industrial motor vehicles. For several years past both France and Germany have demanded interchangeable carbureters on subsidized motor vehicles, and Prince Henry's stirring appeal of two years ago "Germans, Use Benzol!" served to impress German motorists and truck users with the fact that gasoline is not the only motor fuel available. The wisdom of the alcohol-benzol propaganda is shown at present in the European war, where Germany is able to look with unconcern upon the complete shutting off of its gasoline supplies. More than 100,000,000 gallons of denatured alcohol are ready for the motor trucks!

"Wireless" Automobile Top in War.—A report from Belgium by the correspondent of an English automobile trade journal tells of a most extraordinary use of an automobile top. It seems that a British patrol succeeded in capturing a German touring car in which two officers were seated. The motor had broken down and the officers were made prisoners of war. In glancing over the car, one of the patrol noticed a wire connection to the "skeleton" of the raised top. Following the wire he pulled from under the seat a telephone receiver and, holding it to his ear, was dumbfounded when he could plainly hear a message coming from nowhere in particular. The top-skeleton formed the receiving wires of a wireless telephone station, and the message came from the nearest headquarters of the army corps to which the officers belonged.

Automatic Garage Door Opener.—Every chauffeur, and perhaps every automobile owner, too, has on some occasion been wont to swear at the closed door of the garage, which compelled him to get out and open it. A Colorado Springs garage employee has just perfected an arrangement by which the automobile desiring to enter or leave the garage, opens the door automatically, and also blows an electric warning signal affixed to the door. The arrangement consists of three metal plates sunk into the ground at both sides of the door. When the front wheels of the car bear down upon the first set of plates in the street, the garage is opened by an electric motor, which also blows the horn at the door. After the car has passed into the garage its wheels bear down upon a second plate, again establishing an electric contact and closing the door. The third plate is for emergencies only, in case the other should be out of order.

Aeronautics

It is Interesting to Learn that all of the English army aeroplane squadron flew under their own power from their base in England to the scene of action in France, where they have taken a prominent part in the work of reconnaissance.

Battles in the Air.—At the commencement of the war many surmises were made as to what part aeroplanes would take in the maneuvers, and battles in the air between representatives of the opposed forces were freely predicted These predictions have come true, if published reports can be relied on, for it is stated that Vedrines, the French aviator attacked a German machine that was scouting over Paris, and riddled it with an automatic gun with which his craft was armed

Aircraft in the War.—Although the influence of aircraft in the war cannot yet be precisely estimated, its efficiency has already been apparent, for in many cases there is no doubt but that the strategy of the armies on both sides has been guided by the reports of the air scouts who located the position of every army *corps*, and gave warning of the points where troops were being concentrated, and in what strength They have also done excellent work in marking down the positions of the enemies batteries or trenches with such precision that artillery fire could be directed on them without wasting a single shot

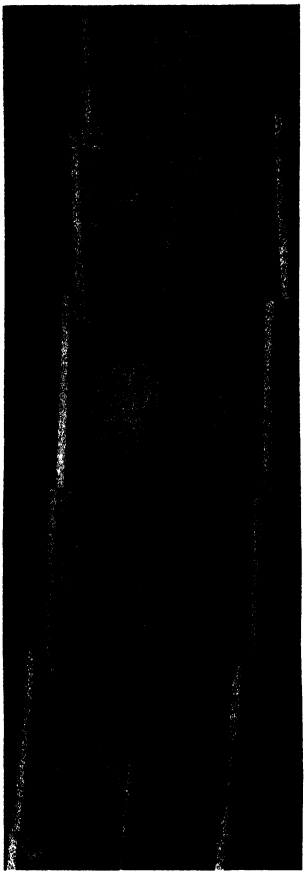
The Zeppelins.—Although but little has been heard of the Zeppelins since the war began, no one seems to know whether their general absence from the field of activity indicates some unforeseen unfitness, or is an indication that they are being withheld with some particular purpose in the future However that may be, it is a fact that these huge dreadnoughts of the air have not as yet lived up to their reputations. It is most probable, however, that the little aeroplane has so far met all of the requirements, and that the larger craft are being saved for other maneuvers

The Question of Noise.—A writer in the London *Daily Telegraph* raises a question that has been altogether too generally overlooked in designing aircraft He says: Whether regarded as a military machine or one used for pleasure, it is evident that from every point of view an aeroplane has everything to gain from possessing a well-silenced engine, and nothing to lose except the fraction of power wasted in the exhaust. Nor is there any reason why an aeroplane motor of the stationary type should not be as effectively silenced as that of the modern motor-car. There is no improvement which would render aviation more immediately popular.

War Aeroplanes.—With a Berlin date an interview with a German military aviator has been published in which many comments are made on what has been accomplished, and the operation of the machines This aviator had been using a Taube monoplane (recently described in the SCIENTIFIC AMERICAN SUPPLEMENT), and found it underpowered, too slow in rising, and that it was not easy to get off the ground in starting, in fact, it was practically helpless with the lighter and faster French and English machines On the other hand, he considered the French machines too light for war purposes, were too easily damaged, and were apt to become useless if left out in the open without protection, or in rain storms

Considerable Anxiety is Felt in London lest it become the object of an attack by German airships, and preparations have been made for repelling such attacks by guns mounted on high buildings, still it is feared that such firing would be dangerous in a great crowded city like London as the shells discharged would be liable to result in considerable damage when they fell back to earth It is the night attack, however, that is most feared, as then even a big Zeppelin would be quite safe from gun fire For weeks no lights have been lighted about Buckingham Palace, and of those encircling St. Paul's Cathedral and other centrally located buildings only a few have been lighted, so that their location may not be distinguished at night Searchlights have been operated at night, but their locations have been changed daily to hide their positions

Aviation in the United States Army.—Following the act approved July 18th, 1914, creating an aviation section and providing for a fifty percentum increase of pay for both officers and enlisted men, while regularly and frequently participating in aerial flights, and also providing that no person, except in time of war, shall be assigned or detailed against his will to duty as an aviation student or officer, Gen Wotherspoon, Major General, Chief of Staff United States Army, has by order of the Secretary of War, issued General Orders No. 98, under date of September 17th, 1914 This order referring to the act of July 18th, 1914, describes some of the details to be followed in carrying out its provisions, and suggests that unmarried lieutenants of the line of the army under 30 years of age who desire a detail in the Aviation Section of the Signal Corps should apply to the Adjutant General of the Army, suitable blanks being provided for the purpose.



Aeronautics, London

Views by the Fabbri Camera.
The several exposures have been matched together to form a continuous record

Making War Photographs from Aeroplanes

The Fabbri Automatic Photographic Apparatus

By Major H. Bannerman-Phillips, English Aeronautic Correspondent of the Scientific American

WHEN for purposes of military reconnaissance or to correct maps already in existence of the country which is to form the scene of operations of an army in the field, it is necessary to send out observers in aircraft, photography must be called in to their aid, if detailed reports and representations of the ground are to be furnished. From a height of 3,000 to 4,000 feet objects at the ground level not only look very different from what they would from a horizontal or only slightly elevated viewpoint, since from aircraft they are seen in plan, and the contours are flattened out to all appearance, but the objects themselves often seem so small as to escape detection entirely. This is more especially the case with the observer in an aeroplane, from the pace at which it travels, and from the fact as a platform for observation it is inferior to the airship. Telescopes and field glasses can, of course, be used, but the vibration of the engine in an aeroplane militates against the use of lenses with high magnifying power, even if the observer should be able to examine terrestrial objects while lying face downward and looking through an opening in the floor of the aircraft.

Moreover, when the area to be reconnoitered or surveyed covers several hundred miles, it is a physical impossibility for the human eye, brain and hand, however well they may co-operate, to do the work required and produce a useful and legible record for the information of the higher authorities, within reasonable limits of time

Science, however, in the person of Capt. Giovanni Fabbri of the Italian Aviation Service, has now come to the aid of the hard-worked staff officer and the airmen of both naval and military services, and has produced an automatic camera, by which a continuous photographic record is obtained of the whole tract of country covered during a flight. There is a double advantage thus secured, in that not only is the observer free to devote his whole attention to the country over which he is passing, but it enables his independent observations to be described later on.

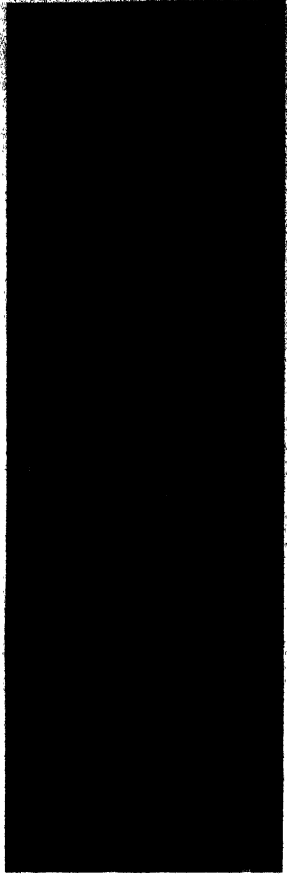
One great merit of the apparatus is its size, and another its simplicity. It can be readily installed in any aeroplane, and while essentially automatic and continuous in its working when once started, it can be stopped at any time and used for occasional single snapshots if so desired

A rough and ready way of describing the apparatus would be: "a miniature cinematograph." It has a roll of film which winds and unwinds over two bobbins. Along one edge of this film are a series of perforations at stated intervals, and a tooth in the side of the camera presses against the film. When it enters one of these perforations, the film is stopped automatically, the shutter released, an exposure takes place and a snapshot of the terrestrial surface underneath at the time is secured. The unrolling of the film is effected by the rotation of a small propeller, driven by the passage through the air of the aeroplane, which rotation is conveyed by a shaft to a chain, which unwinds the film. The shutter is automatically released at intervals by gearing.



Aeronautics, London.

The Fabbri automatic aeroplane camera.



Aeronautics, London

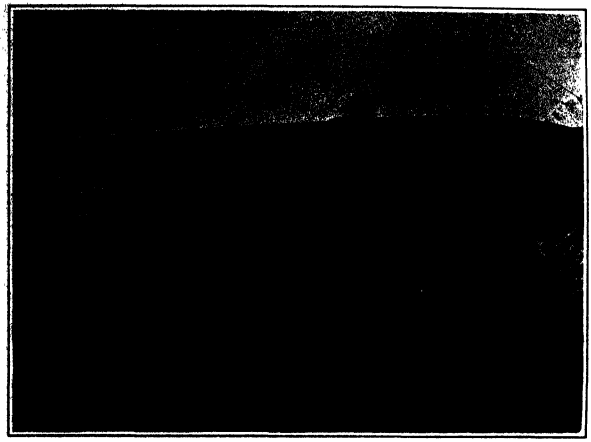
Views by the Fabbri Camera.
Note that each exposure automatically records the compass direction and altitude.

Of course the speed of the film must be regulated in accordance with the pace of the aircraft relatively to the ground over which it is passing, and the velocity of the wind must be allowed for, and there are arrangements for "setting" the machine accordingly. A very important point in connection with the photographic records furnished is that each time the shutter is released the faces of the compass and aneroid are photographed at the same time with the view, and also shown in a corner of the film; and the capacity of the latter is equal to recording at a height of 4,000 feet the features of a tract of country 180 miles in length.

Wireless Telegraphy in the German Army

WIRELESS telegraphy has reached a stage in its development at which it may be said to fairly well established. There types of wireless stations can be distinguished. These are first the permanent or sta-

...or mounted ... considerations on ... Prometheus, ... are located in fortresses ... range of action of 1,500 kilometers (about ... All the German fortresses can be placed ... with the central station at Namen, ... receive messages from strategic and aero-... possible stations are assigned to the army ... The carriages ... they are mounted ... somewhat similar ... carriages, and are ... by six horses. In ... of the heavier ... stations the cars rotate upon the carriage. The operators of the small-... stations are on horse back. Portable stations of the latter type are attached to the cavalry divisions and to those reconnoitering squadrons to which a central reporting bureau is attached. From here all the news collected can then be forwarded to the various headquarters. The heavier stations are placed at the main headquarters and the cavalry division staff quarters. They have a range of about 120 miles, while the light-weight stations have a range of 35 to 45 miles. The stations are used in pairs. When at rest, one of the two stations of the pair is kept in action, while the other is held for reserve. When in motion, they are used alternately, one being in action while the other is being moved forward. It takes about fifteen minutes to set up a station. Dirigible balloons carry only transmitting apparatus, with about one hundred and ninety miles radius of action.



The Fabbri photographic apparatus on an aeroplane.

A, Camera casing; *C*, *D*, bobbins on which the sensitive film is wound; *H*, principal lens; *F*, device controlling booth *G*, which regulates the making of the exposures; *H*, secondary lens which throws an image of the compass *I* and barometer onto the film; *J*, *K*, *L*, *M*, levers for operating the shutters of the lenses *E* and *H*; *T*, air propeller that operates the apparatus; *W*, exposure regulating apparatus; *V*, lever regulating interval between exposures, which must be set according to height above the ground. Single exposure can be made by means of the small crank handle beside the aviator.

The Strategic Island of Helgoland

IF the sagacious men who are directing the naval policy of Great Britain had been in control at the time when Helgoland was ceded to Germany, it is safe to say that the transfer would not have been made. In that transaction Great Britain acquired from Germany a colonial possession of doubtful value, and in exchange handed over to her a small island at the entrance to the Elbe, which to-day is, next to the Kiel Canal, the most important strategic point in the whole scheme of German naval strategy. The island is small, measuring about a third of a mile in breadth by a mile in length. It consists of the Oberland, standing some 200 feet above sea level, and generally flat on its surface, and the Unterland, a stretch of low-lying shore at its foot. At the time of its acquisition in 1890, the island was subject to heavy erosion. This has been prevented by the construction of sea walls and other protective works. The view of Helgoland which we present herewith shows the low-level portion of the island. The value of the island from a naval standpoint lies in the fact that it is situated about forty miles northwest of the mouth of the Elbe, and in such a position that it commands the approaches to the Elbe, the Weser, and to the great naval base of Wilhelmshaven.

The Germans have done an enormous amount of work in developing the full naval value of Helgoland, and anyone who has not visited the island for a few years would be astonished to see what remarkable changes have been made. The fine bathing beach has been done away with, and a large area of land has been made by filling. The island forms one of the most important torpedo and submarine bases for the German navy, and a fine harbor of refuge has been constructed, together with a large number of concrete-steel buildings, some of which are shown in our illustration in the course of construction. These buildings include artillery depots, magazines and hangars for hydro-aeroplanes, etc., together with the houses for the officers, officials, and workmen employed on the island.

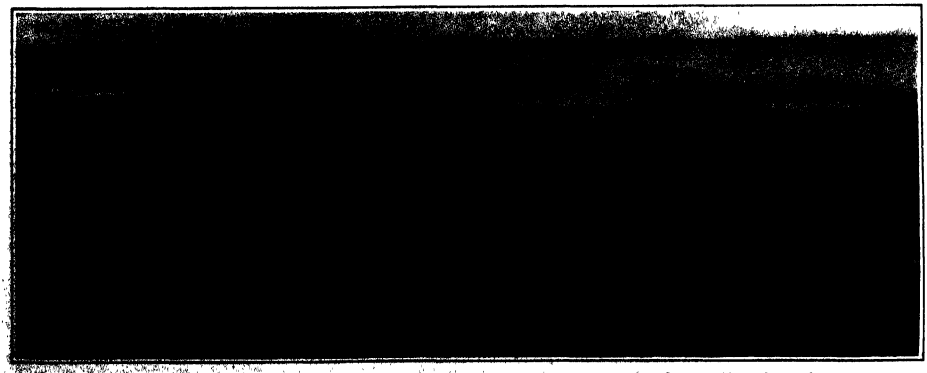
Although Helgoland is still used as a summer resort, only the lower portion of the island is open to visitors. The highland is entirely under the control of the government. It has been very heavily fortified, and the heaviest artillery, both for direct fire and for high-angle fire has been emplaced. The caliber and the number of these guns have never been made public; but the Germans have repeatedly stated unofficially that among the mortar batteries are to be found pieces of 16 inches caliber. It is also stated that 16-inch guns, probably of the mortar type, are mounted on the mainland in the great fortifications at Cuxhaven. The system of defense is stated to be similar to that employed by our own coast fortifications, the whole area of the sea between Helgoland and the mainland and all that area covered by the effective range of the mortars being mapped out in squares, the progress of the enemy's ships through the fields so covered being determined by observation, and the fire of the batteries being concentrated accordingly.

It is possible that some of the 16-inch mortars have been dismounted and transported by rail to assist in the reduction of the Belgian and French fortifications; although, as we explain on our editorial page, we are inclined to think that the 16-inch piece being used in the field by the Germans is a special type of siege gun of lighter weight, firing a high explosive shell of large capacity.

The Franklin Medal

IN addition to other medals which the Franklin Institute has been accustomed to award, it now has at its disposal a new medal to be called the "Franklin Medal," which will be awarded from time to time in recognition of the total contributions of individuals to science, or to the application of physical science to industry, rather than in recognition of any single invention or discovery. This medal will be of handsome design in gold, of a value of about $75, and it is expected that two medals will be awarded each year. This medal is made possible by a donation by Samuel Insull of Chicago.

Some Automobile Developments.—A number of interesting patents have been issued recently for constructions which provide for certain shifting of the cushions and seat backs of automobiles in such manner as to form beds, thus furnishing sleeping accommodations while touring. Whether this will be the accepted style of convertible car, or if other ideas of construction will provide sleeping accommodations, remains to be seen. Touring is becoming more and more popular, and, when occasion requires, facilities accompanying the car and furnishing comfort and shelter at night, should find favor. These may as before suggested include a special construction of the car itself or separate equipments carried like other accessories.



The Island of Helgoland, showing the harbor for destroyers and submarines, and the construction of new machine and store shops.

How the War Affects Our Industries

By L. V. Redman

AMERICA lends all other nations as a self-supporting country. This is true either in times of peace or war, and yet, it is now being demonstrated how vastly dependent is the most independent nation in our modern complicated system of civilization.

Chemistry is the least national of all our industries. It is international. Our International Chemical Congresses recognize five official languages—English, French, German, Italian, and Russian, and a first-rate chemist is supposed to read any of the five scientific languages fluently; in fact, it is almost a necessity for a chemist to be a pentalinguist

The present European crisis is emphasizing how complicated is our civilization, even here in independent America.

For example, the glass industry Our potash comes from the Strassberg deposits in Germany Our potash supply is cut off and our glass industry is in imminent danger, for potash is absolutely necessary in the making of all our ordinary glass

Many of our photographic supplies are imported. The present war has sent the prices soaring. Metol is a substance which has risen in price in three weeks from $8 to $12 per pound, and other photographic chemicals have risen in like proportion.

A common article is carbolic acid crystals. This chemical has risen in price from $8 per hundredweight to $50 and is still rising Presumably this material is needed as a base for explosives in mellinite and lyddite shells and a disinfectant, and an embargo has been placed on its present export by Great Britain and Germany

The steel industry is also affected The iron ores, the coke and coal are all mined in this country, but in the making of manganese steel pyrolusite is necessary, and this chemical has risen in price from $38 to $125, and the supply is limited

Magnesium oxychloride, from which artificial marble is made, is imported from the Mediterranean The source of supply has been cut off from the United States, at least temporarily

Celluloid and galloflth are chemical products in common use everywhere All the cheaper grades were imported from Europe. The source of supply is completely cut off, and America must look elsewhere for her supplies or have her chemists double and treble their present output.

Almost every dye product has risen in price, although this is unreasonable in many respects, as America makes large quantities of dyes, and while the present conditions may require a rise in prices to pay for the uncertain venture in increasing factories to meet what must be considered as temporary conditions, yet the price is in many respects unreasonable For example, two dye firms in Chicago were asked to bid on the same day at the same hour, over the telephone, on one of the commoner dyes, tartrazin The regular price does not exceed 75 cents per pound. One company offered the dye at the regular price, the second company asked $3.50 for one fourth of a pound, and we were told we would have to talk fast to get it at that price, as the demand was very heavy. This reminds one of the talk recently about the necessity of raising prices on beef to protect the customer, consumer, etc.—a rather doubtful form of protection at the best!

Research chemistry is paying its portion also on the increased prices Jena glass has advanced 30 per cent, as it is imported from Germany, and a continuation of the war means a complete exhaustion of the small supply carried here in America

Fortunately, we have some chemicals which are distinctly American products, and these jog along at the regular pace and price—alcohol wood alcohol, turpentine, rosin, acetone, formaldehyde, acetic acid, and wood products generally are holding their own against the menace across the sea

If the European war continues for eighteen months or longer, it gives the American chemist a rare opportunity to double and even treble his factory's output in order that he may supply the American market with American-made chemicals and stop the heavy toll of $60,000,000 per year, which we are paying to the European chemical market Not only will we save the $60,000,000, but America will be yet more unaffected in times of peace or war.

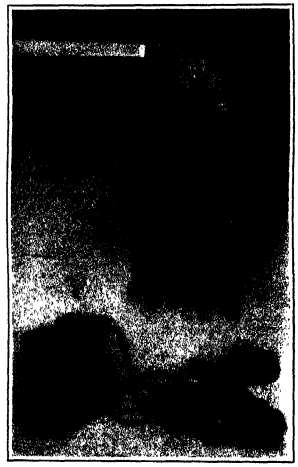
The manufacturer may ask what are the chemicals which are so needed at the present time in America and which have been restricted or cut off entirely by the present war

We buy annually from Europe three fourths of a million dollars' worth of quinine, four million dollars in glycerin, one million for indigo, two fifths of a million for licorice, crude tartarates, two and one fourth million, for carbolic acids four millions of dollars are paid annually to Scotland, Great Britain, and Germany, one million for fusel oil, three fifths of a million in gums, two and one half million dollars for aluminium, potash salts ten million of dollars, four and one quarter millions for platinum.

New Flashlight Signal Apparatus for Army Use

METHODS of signaling at a distance have played an important rôle in warfare of all ages. Modern conditions of military maneuvering have, however, greatly multiplied the importance of this branch of the service. Not only do the great modern armies exceed in point of size those of the past, but the immense range and the great accuracy of modern fire arms have caused a corresponding spread of bodies of troops both as regards breadth of front, and also as regards depth. It hardly needs to be pointed out that the importance of methods of signaling has risen *pari passu* with this broadening of the territory covered by the troops, to say nothing of the influence of modern reconnoitering facilities, notably by aeroplanes and airships.

The new needs have been met, it is true, in a measure, by various of our standard means of communication, after special adaptation for the field work of the army. Wireless telegraphy, automobiles, flying machines, carrier pigeons, mounted messengers, bicycle couriers, the telephone, and semaphore signals all serve their purpose in this field, but all have their limitations also. In many ways the ideal method of signaling is that by flashlight. However, in order to make this method really satisfactory, the beam must be of the form of a narrow cone, or, better still, of a parallel



German military signal lamp and field glass.

pencil of light, in order to prevent any but the proper person from catching the signal

A device recently designed with these points specially in view is described by Major Fuller in a recent issue of *Die Umschau* It consists of a pair of binoculars over which is mounted a small parallel-beam flashlight. This latter comprises a steel tube *a*, with a socket chamber *b* to which the lamp is attached; a contact box *c* with a push button *d*. This flashlight is screwed upon the binocular at *e*. The battery for lighting up the lamp is carried in a leather case from the soldier's belt A duplicate battery is also carried in the same case

The mode of use of this apparatus hardly requires explanation. The flashlight torch is so adjusted, that when a given point is sighted with the binoculars, a beam of light, sent out by the torch upon pressing push button, is directed at the point sighted. Some suitable point is selected as the stationary central, to which signals are sent from the moving observers in the field. These are, if necessary, kept posted as to the location of the central station by flashes sent out periodically in their direction. Except in the immediate neighborhood of the flashlight lamp, the beam can be detected only by persons directly in line with it, unless indeed there are intervening objects in the way. On this account caution is required in using the instrument in wooded regions, for example.

As regards the range of the instrument, it is claimed that under favorable circumstances signals can be sent over a distance of some six miles, though, generally speaking, the range is probably only about one half of this. Even in daylight the signals can be used over a distance of something over half a mile, or considerably farther if the background is particularly advantageous.

A Talk to Inventors on the Oldfield Bill

"No person who obtains a license to use any patented art or process . . . shall be liable to an action for infringement of the patent because of the breach of such license or of any provision thereof."

SUPPOSE that you are the inventor of a process of tanning leather. You make a license agreement with a leather manufacturer who produces only low-grade leather for cheap shoes; you license him to use the process only on that leather; you agree that he alone may use the process on that leather, and accordingly you charge him a royalty of one cent a square foot—a proper and fair royalty in the circumstances. Suppose that you make a similar exclusive contract with another manufacturer who produced only high-grade leather for fine shoes, and that you charge him a royalty of two cents a square foot, again a proper royalty, because, either by adding to the quality or saving the expense of manufacture, the licensee can afford to pay you the two cents and still make for himself a considerable additional profit and give the public better value for its money. If the Oldfield bill becomes a law, that passage in it which stands at the head of this column, will prevent you from recovering against the first licensee if he applies your process in manufacturing high-grade leather. In other words, the Oldfield bill, if enacted into law, will facilitate breach of contracts and encourage dishonesty and bad faith in business.

Again, you may invent a new form of steam engine; you may license one man to make your steam engine for railway purposes, another man for ship propulsion, a third man for driving electric generators, and a fourth for general power purposes As the patent law now stands, if either one of these licensees invades the field of the other, that is, uses your invention outside of his license, you may successfully sue him on the patent, because he has admitted the validity of the patent. Any court will grant a preliminary injunction. Take away this right, and not only have you lost the benefits which you expected to secure by this division of the business, but you have been party to what amounts to a fraud on your other licensees.

Is there any reason why anybody should ever take such a license under a patent if the law is changed as Mr. Oldfield would have it? If Congress passes the Oldfield bill it would be very much harder for inventors to grant licenses. Manufacturers who wanted the patent only for one purpose would insist on buying the whole patent; otherwise they could obtain no protection in their particular line of work. But such an outright purchase would not only limit the gains of the patentee from his invention, but might tend to deprive the public of the use of the invention in the other fields; for it frequently happens that one concern is not in a position to exploit an invention for all purposes. Consider now this clause in the Oldfield bill:

"No person selling . . . any article of manufacture under a patent shall have any greater right to prescribe . . . conditions limiting the use than if the article were not manufactured under the patent"

Suppose that you have patented a sterilizing process, by which milk can be kept sweet and good and wholesome for three days without injury to its flavor or appearance The general use of that process all over the country would be something which the courts and the legislature and the public ought to encourage in every reasonable way. You might be doing business in Boston, might use the process in that city, do much good to the inhabitants there, and make some money for yourself; but a man in New York and a man in Chicago and a man in San Francisco might come to you and ask for a license to use that process in these various cities, respectively. It would, obviously, be out of the question for you to carry on the business in every city in the country, and it would be for the public interest that you should put the process into use as rapidly as possible all over the country You would be perfectly willing to license one man on a reasonable royalty in each of these cities, and in any city, say twenty miles from Boston, but you want to reserve the business in that area for yourself.

The patent might cover a perishable article, an article of food, for example, which had to be consumed within twenty-four hours after it had been made, and you might be selling that article in Boston and be absolutely unable to sell it in any other city. In either of these cases, or in any one of thousands of cases, it may be for the public interest and for the interest of the patentee and the licensee that territorial licenses should be granted and respected.

The paragraphs quoted kill territorial licenses just as they kill licenses for any particular field of work. The Oldfield bill, from this point of view, ought to be entitled "A Bill to Diminish the Returns of Patentees and make it Difficult for them to Derive Revenue by Granting Licenses."

It is easy to draw these general clauses, but hard to see what they mean or to realize the different situations in which they will work harm. For example, it has frequently happened that an extensive, costly research and brilliant invention have resulted in a radical improvement in a machine, and yet the patent was really obtained on some physically small portion of the machine. Such a case was recited in the testimony taken before the committee at the hearings on the first Oldfield bill.

Let us assume, for example, that an inventor makes an improvement in phonographs, the improvement consisting in a new diaphragm, which can be applied to an ordinary graphophone and will result in giving a much louder and much clearer sound, and let us assume that this inventor, either through himself or through a company organized for the purpose, puts the invention upon the market. Now the graphophone sells for from ten or fifteen dollars up to three hundred dollars, depending upon the size of the resonating parts, and there is practically no difference in the diaphragm or the actual reproducing parts of most of these devices. The extra price is put into the larger resonating box and a larger and more ornamental case. The diaphragm would probably cost so little that the inventor would be perfectly willing to sell it for five cents to anyone who wanted it for its legitimate use, that is, for replacing a broken or injured diaphragm of a graphophone purchased from the inventor. But there happens to be several great corporations engaged in the business of manufacturing talking machines and phonographs. Their business would be threatened, and they would naturally try to buy up all the diaphragms they could get and put these diaphragms on their phonographs; that is, they would buy a five-cent article which would be used to double the value of a three-hundred-dollar machine. With the new diaphragm, of course, they could get the business, because they have reputation and prestige, contracts with singers, established channels of distribution and good-will. The one hope the inventor could possibly have of doing a large and profitable business on his invention, resides in inducing the public to buy diaphragms from him, because his diaphragm makes the phonograph so much better. Yet, if the Oldfield bill is passed, the most reasonable and ordinary precautions which he must take to confine the diaphragms which he sells to their legitimate use will be rendered unlawful or their effect will be nullified. This means that the inventor is driven to the existing companies and practically forced to sell the patent for what they choose to give him. None of the companies can afford to give him very much, because it will have no way of keeping the other companies from getting a supply of the diaphragms. The value of such a patent, and the inducement to invent, perfect, and market such devices, will be substantially destroyed. Probably the Oldfield bill was not intended to have this effect; yet that is one of its inevitable effects.

The bill provides that a license shall be granted if the invention is being withheld or suppressed "for the purpose or with the result of preventing any other person from using the patented process, etc., in competition with another article or process patented or unpatented used . . . by the owner of the patent." No one knows exactly what this means, and no one ever can know. Suppose an inventor has a broad fundamental patent which has five years to run and has worked out the invention in two scientific forms covered, respectively, by two separate patents, each of which has ten years to run, and suppose that, after thorough test and investigation, he has satisfied himself that one of these forms is just exactly as good as the other and no better. For manufacturing reasons, under these circumstances he would make only one of the two forms. On the assumption made, why should the patent owner be required to grant any license whatever? Suppose he is required to grant a license. What license shall he be required to grant? Will it be merely a license under the second of the two later patents, the one which has ten years to run? Surely it is not the intent of those responsible for the bill that this should imply a license under the broad patent, and surely a man should not lose his exclusive rights under a broad patent because the invention of the patent can be embodied in two or in twenty devices, and he does not make them all. If the license were granted only under the second patent, the one which had ten years to run, that license would for five years be absolutely useless to the licensee, because the first or broad patent would prevent him from using the invention.

Another case to be considered is the common one where the broad patent shows the device in a very imperfect form. An instructive illustration was the original Bell telephone patent. This patent was good and valid and was sustained by the Supreme Court of the United States over and over again, but the telephone disclosed therein was so poor that it would scarcely talk and was utterly uncommercial. Bell and his assignees improved on the original patent, and others improved. The telephone company bought the patents or took licenses under them, and finally were able to make the telephone of commerce as it existed, say, fifteen years ago. This last telephone was different in appearance, even in principle of operation, from the original telephone, but it came under the broad patent because it utilized the broad invention. The company "suppressed" the original telephone of Bell because it was inferior. Is it the intent of the Oldfield bill that in these circumstances an outsider shall receive a license to make this original Bell telephone, or any one of the hundreds of different forms of telephone which the Bell Company, one after the other, developed and abandoned for something better?

If this is the policy of the law, there would be a restriction not only on invention, but on the disclosure and utilization of the invention. If, under the circumstances, the Bell Company had a satisfactory and workable telephone, and one of its employees should invent a much better telephone, the Bell Company's lawyers would advise it that should it patent and market the better form in substitution for the existing form, the existing form would be open to all its competitors under this compulsory license provision. Surely under these circumstances the Bell Company, if actuated by selfish motives, would order this inventor to forget the invention, would refuse to let its research department develop it, would not give it to the world in a patent, but would suppress it forever, if possible.

Experiments Upon Concrete

THE surface of concrete is frequently treated by the use of the pounding rod with enlarged circular end, so as to compress the material at the surface. Such compression has quite an influence on the strength of the concrete, so that in order to have uniform quality over a given surface, it is required to give the same number of strokes of the rod at all places. Tests made with a mechanical pounding device were quite conclusive; for instance, using 60 strokes and 40 strokes, the corresponding figures for strength were 201 and 108, while hand-molded concrete without pounding showed only 66. Applied force is of less effect than the number of strokes, but this number must not be exaggerated, or else the denser materials are forced into the lower parts of the layer and the mass is no longer homogeneous. A workman can give 50 strokes of a 30-pound tool per minute under best conditions, but the work is not constant during the whole day, as the effect in afternoon falls below that produced in the morning. As hand labor fails to produce concrete of uniform strength, this led to the invention of a pneumatic tool by which the pounding can be easily regulated and is quite uniform. Such a hammer can give 300 or 400 strokes a minute on the larger surface, and the work man confines his efforts to sides and corners of the work. A plant of this kind is a simple one and comprises a motor-compressor, piping, and the pneumatic tools, the pump group being mounted on a small truck. Per 10-hour day, 100 cubic yards of concrete are treated, using 8-inch layers, and for large work this cuts down hand labor about 80 per cent.

The Current Supplement

IN the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2025, for October 24th, there will be found a short description, together with a number of illustrations showing some of the details of the big passenger steamships recently built that enable one to gain an idea of their great size. An article on Modern Research in the Metallurgy of Iron gives valuable information about this indispensable material, and also treats scientifically of the composition, properties, and characteristics of steel. Extracts from the address of the president of the Geographical Section of the British Association on Man as a Geographical Agency review what man has done in recasting the geography of the world. Some Recently Discovered Nubian Antiquities describes and illustrates the finding of many articles that add much to our knowledge of the history of Egypt. The Electrically Driven Gyroscope in Marine Work tells of a few of the valuable applications of an instrument that not so long ago was merely a scientific toy. The Origin of Waves, a description of an instrument that automatically calculates the dead reckoning of ships and other readable articles make up an attractive issue.

Motor River Boats in France

A NEW type of motor craft is now in use on the Saone River near Lyons, it being built for the Lyons Navigation Company. The dimensions of such craft are such as to allow them to run in the standard canals, or 125 feet length by 16 feet width. Power is obtained by the use of a crude oil engine of 40 horsepower, and boats of the present kind will take a net load to 230 to 250 tons freight. Should the proposed river improvements be extended to Paris, such boats will ply between that city and Lyons and will do excellent service.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Triumphant Struggle With a Beetle

To the Editor of the SCIENTIFIC AMERICAN:

In your number of February 28th, 1914, I read with much interest an article entitled "A Triumphant Struggle with a Beetle," by H. J. Moore, and I am sending to you under separate cover two or three papers which give the result of our work here in Trinidad with this same fungus as a means of control for the froghopper, which is the most serious insect enemy of the cane plant in this island. Although this fungus has been known as an insect parasite since 1879 it is only within recent years that it has begun to play an important part in insect control, and it promises to be of great value, especially in the tropics, where our conditions of temperature and moisture are much more favorable for fungus growth than in temperate zones.

Since the publication of our first paper in 1910 giving methods by which this fungus can be successfully grown, we have had requests for cultures and spores from practically all over the world, and now the fungus is being tried out as a means of combatting a number of insect pests in different places. Although by no means an absolute method of control, the use of this fungus, together with better methods of cultivation, promise to keep the froghoppers well within bounds.

JAMES BIRCH ROREB,
Mycologist, Board of Agriculture
Port-of-Spain, Trinidad

Misinterpreted Wireless Signals

To the Editor of the SCIENTIFIC AMERICAN:

In your issues of May 16th and June 6th, 1914, are letters discussing misinterpreted wireless signals, following up more or less scientific discussion of the use of the "S O S" signal.

I have yet to see any noteworthy writing on the subject which takes into consideration the human element, best expressed by the now famous phrase, "The man behind the gun."

On the large railroad systems it would be thought somewhat unusual to put a track-walker on as engineer of one of their up-to-date engines.

But many wireless operators are working to day who are as much out of place as the latter would be.

These men are licensed, but many of the licenses are issued by officials who themselves are not telegraphers, and who are absolutely incapable of judging the applicant's qualifications. There are army officers in this territory authorized to grant such licenses, and who are wholly unable to judge of the applicant's fitness.

And the examinations prescribed are stereotyped matters that any man may pass after a little "cramming" and still be entirely unfit for the work.

Men are licensed directly upon leaving some school, or after amateur practice, and given responsibility for the lives of hundreds of trusting victims, but these same men would not for a moment be employed by a railroad and given responsibility for their more (?) valuable property.

And such officials as the above give licenses, stating that certain men are telegraphers. How did the official find it out, if the men are?

How *could* they find it out, knowing nothing of the subject themselves?

Among American telegraphers there is found the use of the word "operator," in a purely technical sense, as distinguished from the word "operator" as used in ordinary writings. The real telegrapher never uses the word "operator" in the latter sense. It is not recognized in his vocabulary. When he does use "operator," he refers to a capable and experienced man, master of his trade.

These men laugh among themselves about such errors as that of a man who is trying to make the combination "M B S" and succeeds in making it sound like "S O S." This error was not the result of accident, it was simply gross inefficiency. Such a man might easily distort a dozen combinations into "S O S."

Instances can easily be found of ships traveling at sea for days, unable to communicate with any other station, simply because of the inefficiency of the "man behind the gun," while hundreds of passengers dependent upon him for safety sleep or eat in fancied security, protected by stringent (?) laws.

Why is this?

One reason is to be found in an examination of the rate of pay given these men, which is ridiculously small for a skilled trade.

A little investigation and legislation having to do with the personnel of the wireless service might accomplish something.

H. B. JOSEPH,
Fairbanks, Alaska.

Letters from the Firing Line

By an Officer in the French Army.—Special War Correspondent of the Scientific American

[*The author of these letters is an artist as well as an officer, and the accompanying sketches are from his pen. Naturally his emotions over the damage done to the Cathedral of Rheims are very intense and the destruction is described most feelingly.*—EDITOR.]

IT has been raining incessantly for several days, and the nights are very cold. The beginning of this autumn strangely recalls that of 1870. In that year, from the middle of September, the frost began to torture our troops—a terrible year in every sense, one which abounded in misery for everybody. Of course, it is not possible to establish the least resemblance between our brave but poorly equipped army of that time—the army of the empire—and our admirable army of to-day—the army of the republic. The suffering from the cold is greatly to be dreaded; for pleurisy and bronchitis, which may visit the soldier, are just as deadly as the exploding of the shells or the rain of bullets has looked upon such things as these can never forget them, and the image of it will be stamped in his memory as the very climax of horror until the tomb closes over him. What I have seen on the battlefield will remain pictured indelibly in my mind until my dying days. Nature herself, with her storms, earthquakes, volcanic eruptions of burning lava, and clouds of smoke, never produced a more stupendous chaos and never opened a deeper sepulchre than this incalculable artillery which for many weeks has roared and spit shells upon a front of 200 kilometers, from Saint Quentin to the Argonne.

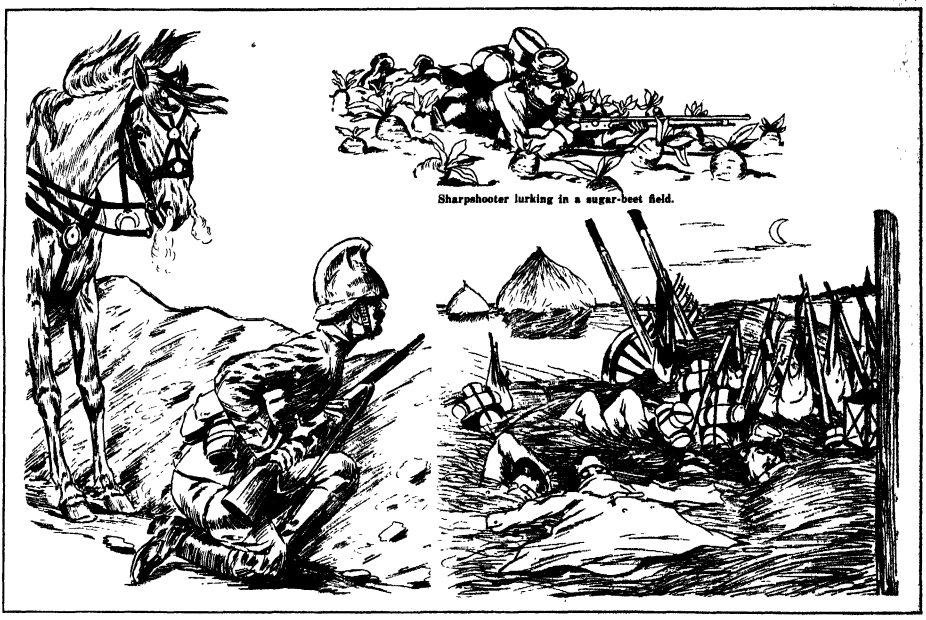
To-day they are cleaning up the battlefield. The corpses have been picked up and placed in a row, while the men, their nostrils plugged with cotton saturated with a disinfectant, are digging the ditches to receive the dead. The Germans, when they do not inter their dead in trenches, pile them in a heap, cover them with straw, pour kerosene on them, and burn them. A terrible odor, an odor of decayed meat, mounts from all this putrefaction. It grips our throat, and for days it sticks to us. While I am writing these lines I smell it still thick around me. In vain the wind blowing in gusts across the plain tries to sweep it all away. It succeeds in dissipating the swirls of smoke which rise from all the burning stakes, but it cannot drive away the odor of death.

The nearer we approach the plateau de sesuane the more evidence we have of the precipitance of the German retreat. A Taube aeroplane pierced with shells and shrapnel fell on the left of the road; nothing remains but the frame. Dead horses, swollen and hideous to look at, are scattered about the roads of the retreat, which are still littered with straw taken from the neighboring fields, and upon which the exhausted troops of the enemy had rested a few hours.

The Germans retreated so quickly toward the north that they left behind a mass of shells inclosed in willow baskets, together with thousands of cartridges, helmets, etc., and in addition to these military remains there were empty bottles of champagne and innumerable portefolios and pocketbooks torn open and empty. Along the road the telegraph wires are all cut and the poles are pulled down. The track of the railroad has suffered little, but I cannot say the same thing for the dwellings—smashed in, riddled with balls, torn by shells, broken windows. Sometimes, as the hazard of war decreed, beside a house that is entirely destroyed another dwelling will be standing intact with the curtains still hanging at the window, and a pot of bright red geraniums blooming on the sill.

In a barn a Saxon ambulance is put up. Twenty or twenty-five Germans are gasping in death throes upon miserable pallets. Two army surgeons are dressing their wounds. One of the Saxons is naked and bleeding. The surgeon is sewing up his back, baring places of his flesh. Speechless and coldly I looked upon this horrid spectacle. The enemy surgeon tries to excite my pity. "See," he says to me, "our poor wounded men." "I have seen as pitiful a sight among our men," I replied.

A more appalling sight is that of the abandoned dead left without burial, and that of the wounded lying



Sharpshooter lurking in a sugar-beet field.

French dragoon scouting.

Bivouac on the allied line.

and the thrust of bayonets. All precautions have been taken, and each of us is in a good condition to withstand the first cold.

Is there any man living whose imagination can evoke the enormous and formidable battle that spreads from the extremity of the Isele France, across the boundary of Champagne? It is not a battle of men, it is a battle of giants, and there is no record of anything like it in all history. For ten days two furious and tragical masses of humanity that has lost all feeling of humanity have thrown themselves against each other with an ever increasing violence. On the enemy's side there is a solid iron wall of obstinate troops frozen by a terrible discipline, which will break to pieces one day. The Allies' side is a battering ram hammering away without cessation and directed by an unseen and unparalleled hand which is moved by the soul of patriotism. It is the cord of the human energy stretched to the breaking point, although the sun-burned and toughened faces show beneath their apparent placidity an indomitable resolution. The pen of Tennyson writing the "Charge of the Light Brigade" could only give the slightest idea of this terrible shock—a terrible and gruesome vision which surpasses in imagination Edgar Allan Poe, Shakespeare, Dante. The human eye which

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helpless on the roadside and in the ditches. Our ambulances gathered up the wreckage of the retreat.

Farther along the road there defiles in front of us a convoy of prisoners, horsemen, infantry men in khaki costumes; they are tired and thin, with hollowed cheeks, marching as if they were drilling and conducted by French mounted police. They have just passed before a big train of their automobiles which a detachment of our own cavalry had surprised and destroyed. The tanks of flaming gasoline had consumed all the framework. The armature alone is left all tangled up and twisted on the border of the hill, and beneath the blackened branches of the trees which the flames have attacked.

The artillery duel roars incessantly between the hills that frame the valley. The mass of the infantry, which is admirably protected by our good guns (seventy-five) continues its advance under the rain of shells which plough the soil, digging large furrows in the ground—the grave of many of the soldiers.

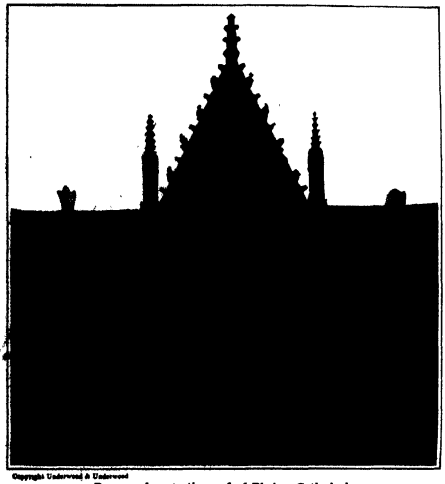
Night has fallen, and with it silence. An odor of blood, of fire, and of death hovers now upon the darkened fields.

* * * * * * * * * *

The Cathedral of Rheims is in flames. I cannot speak of anything else to-day. It is a stab at the heart of

ing blocks of stones which had valiantly resisted the storms of many centuries fell with a terrible crash.

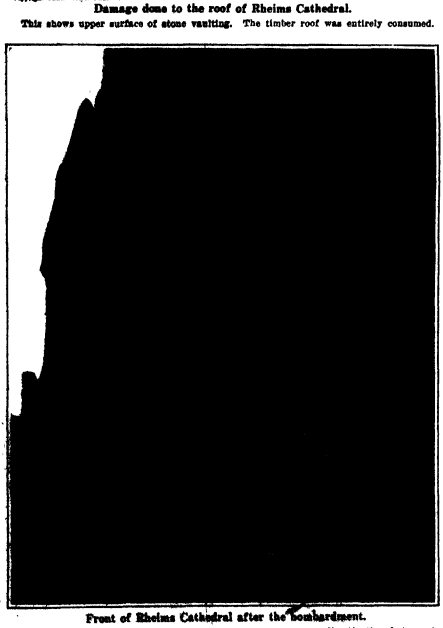
The cathedral is almost entirely destroyed. The roof has fallen in, the rest is still burning, and we can see only the walls through an immense cloud of smoke. The cathedral was surmounted by the Red Cross flag—there were indeed some wounded inside, and especially Germans; but this, like some other of our hospitals,



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Damage done to the roof of Rheims Cathedral.

This shows upper surface of stone vaulting. The timber roof was entirely consumed.



Front of Rheims Cathedral after the bombardment.

Many carved figures were seriously damaged and can be seen headless in the photograph.

In their disappointment not to be able to annihilate Notre Dame of Paris, they have vented their anger upon Rheims.

The German generals and the Emperor issued a declaration of war against all that is greatest in the world, when they turned their guns on the place where Clovis embraced the Latin civilization. This metropole of S'Remy, unique marvel of art, where lived in the sacred stones, under the great statue of the Christ, a whole world of saints whose martyrdom was renewed by the fire of the German shells! God himself hovered over this cathedral of Rheims, the heritage of all those who professed Christianity. When I saw them so close to Rheims I thought "they will not dare to touch the cathedral" I thought that when they aimed their guns something would cry to them in their hearts; that this church was sacred and not to be violated; that it was the parthenon of art, and the property of the world!

But they have done it. Nothing has held their hands back. We cannot say as the Christ on Golgotha "Forgive them for they know not what they do." They did know. They knew very well the great artistic and moral value of this master work which they have destroyed. They knew every stone of it; for the German army as well as the French is composed of every class, including the savants and the artists.

A Caoutchouc-like Material Made Out of Fish

A WELL-KNOWN German chemical weekly tells of a process for making a very elastic, caoutchouc-like material out of salt or fresh water fish. The process in brief is as follows: 100 kilogrammes (about 220 pounds) of fish is treated with 400 liters (about 110 gallons) of water for two hours at a temperature of 90 deg. Cent. (about 194 deg. Fahr.). The aqueous extract is then freed from the solid residue by filtration, and a test is made with a small portion of the filtrate to determine how much dilute sulphuric acid, or sulphurous acid in gas form or in aqueous solution is necessary to precipitate completely the lecithin containing albuminous bodies which are precipitable by acids. The necessary amount of acid, as calculated from the test, is then added to the filtrate, and the precipitated albuminous bodies are then removed by filtration.

The clear filtrate obtained in this manner is treated with a concentrated solution of barium hydrate, which has been warmed to a temperature of 50 deg. Cent. (about 122 deg. Fahr.), until a plainly perceptible alkaline reaction is obtained. In place of the barium hydrate solution a dilute aqueous suspension of calcium hydrate (milk of lime) may be used. Immediately after this the whole mass is treated with carbonic acid gas, until it shows a weak acid reaction. The barium of lime precipitate is removed by filtration, and the filtrate, to which formaldehyde has been added, is concentrated in vacuo. During this evaporation, traces of free carbonic acid escape, and the resulting product represents an elastic mass, not unlike caoutchouc in its properties.

A Mountain of Rock Salt.—A mountain of rock salt, 300 feet in height and nearly a mile in diameter, is described by Prof. E. F. Gautier as occurring near Jelfa, Algeria. Two other hills of this character are known in Algeria, both being near Biskra, and in all cases the salt is surrounded by Triassic marls and clays. A curious feature of the Jelfa Hill is the fact that in spite of the very soluble character of the material composing it, it stands up in high relief from the surrounding clay, and contains no valleys or other signs of erosion. It does, however, contain a number of sink-holes, as in a limestone country. When the brief torrential rains of winter occur, the water sinks almost at once into these cavities and soaks through the permeable salt, emerging at the margin of the hill in salt springs. The same showers falling on impermeable clays and marls produce a maximum of mechanical erosion, so that these substances are worn away, leaving the salt in high relief.

Strategic Moves of the War; or the War in Europe

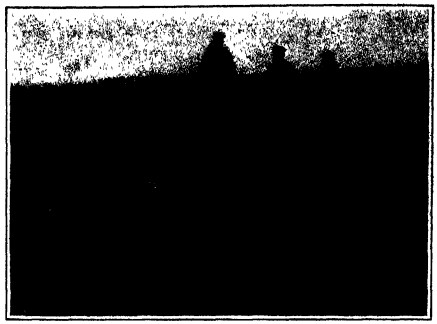
Letter from the Military Correspondent of the Scientific American, October 17th, 1914

THE capture of Antwerp on October 9th is the most important event of the month in the campaign in France While maintaining her position along all the rest of the line, Germany has been able to achieve a gain in Belgium that will materially aid her general plan of operations. Antwerp's inner line of defense consisted of fifteen forts, of which the major portion were constructed in the decade following 1860 according to the plans of the noted Belgian military engineer, Gen. Brialmont. The increase in the effective range of artillery and the growth of the city had rendered this line of forts too close to the city, so that much discussion was carried on in the Belgian legislature chambers during the last twenty years as to the need of a new line in order to hold an enemy off at a greater distance. This plan was finally accepted, and the forts were authorized as funds permitted At the outbreak of the war the defenses were completed on the south and east except for some items of ordnance, which it was claimed that the Krupp works had purposely failed to deliver

While their main armies were prosecuting their campaign in France, the German garrison of Belgium constructed a line of field works covering the front of the southern and southeastern forts of Antwerp, and under this protection they constructed emplacements for the fire of their big 11-inch field howitzers When everything was ready to furnish a powerful artillery bombardment to support the assaults of attacking columns, the army for this purpose was assembled.

So far as its caliber is concerned, the 11 inch howitzer is not a new piece of ordnance, for eleven inches is one of the standard calibers for the permanent coast defense of European nations. We employ an even larger caliber in the 12-inch mortars, with which our coast forts are armed. But up to 1904 the five-ton 7-inch field howitzer was considered the largest gun that could be moved readily enough for use in siege works.

The Japanese started their bombardment of Port Arthur with this type; but found progress so slow that they attempted the unprecedented feat of bringing up several sea coast 11.2-inch (28 centimeters) howitzers. This was accomplished after much time and labor, and in the fourth month of the siege these heavy guns started their fire. The Russian forts were built to withstand only the bombardment of the lighter shell, and were gradually destroyed by the powerful explosions of the shells from these guns. After the bloody battle and capture of 203-meter Hill the Japanese used this as a lookout point to check up on their fire on the Russian battleships, and then, by the fire of these big mortars, forced the sinking of the warships in the harbor.



High-explosive shells bursting deep within the emplacement have completely inverted this gun and its turret.

The Germans profited by this example and set to work to design an 11-inch gun for transportation over metaled roads While this last meant a large increase in mobility over the previous rail transportation, it also required a reduction both in total load and in unit load on the wheels. By using moderate charges of slow-burning powder (the so-called smokeless), which makes it possible to secure good ballistic results with low pressures in the gun, the strain on the gun was reduced so that less metal was required. The development of modern gun steels of increased tensile strength permitted a further reduction in the thickness of the gun cylinder. By all of these modifications a gun was developed that weighed considerably less than the one used at Port Arthur.

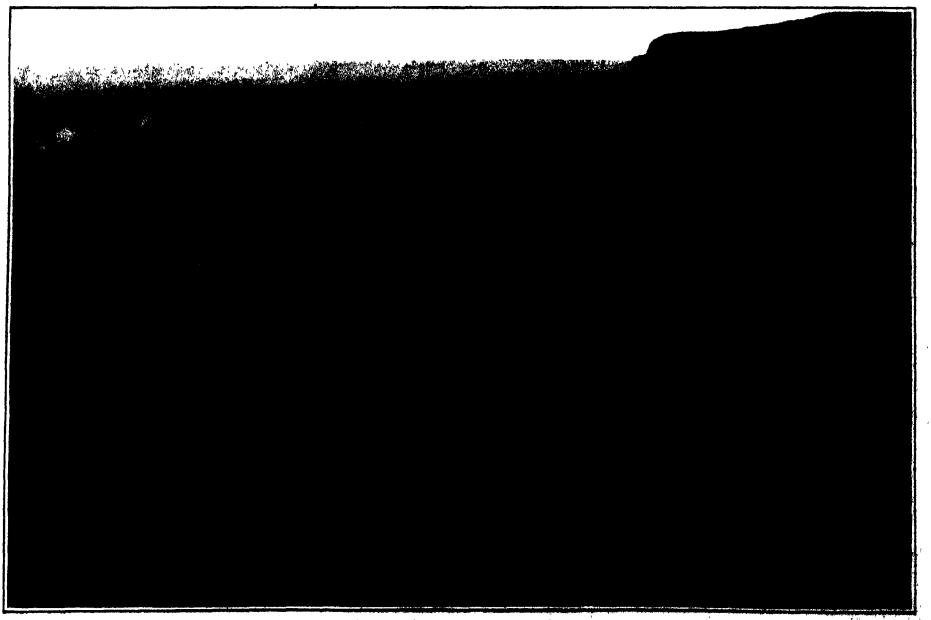
In order to divide the weight for transportation, the gun is taken out of the frame and is carried on a specially constructed truck, while the carriage is provided with wheels and is transported as a separate piece. The wheel pressure on the roadway is brought within safe limits by providing a broad tire of linked plates similar in principal to the caterpillar traction engines used in soft ground or sandy districts.

When firing a 484-pound shell, with a powder charge of 22 pounds, this howitzer has a range of 10,000 yards, or six miles. When firing its heaviest projectile, 700 pounds, with 16.5 pounds of powder, the range is 7,000 yards, or four miles.

The effectiveness of the fire of these heavy guns is due to the large charge of high explosive contained in their shells, about one sixth of the total weight. Fortifications are, for reasons of economy, proportioned to withstand the heaviest ordnance that is expected to come against them. When, as in this case, an unusually powerful bombardment is brought to bear, the roofs and walls of the bomb-proofs and casements are blown in, and the guns of the defenders are put out of action.

It was by such tactics that the Germans scored their successes against the Antwerp forts. By the bombardment from the south, Forts Waelham, Wavre, Koniga-

(Concluded on page 341.)



This photograph seems to prove that "there is nothing left but the mobile field army."

The Colossal Group on the Grand Central Terminal in New York City

ASSEMBLED above the façade clock of the Grand Central Station in New York city is a stone group, which, to the spectator on the sidewalk below who glances up to note the time, must seem little more than life size, but which nevertheless weighs something like 1,200 tons. Every spectator will find it difficult to realize that the height of the central figure is 25 feet and that the diameter of the clock itself is thirteen feet.

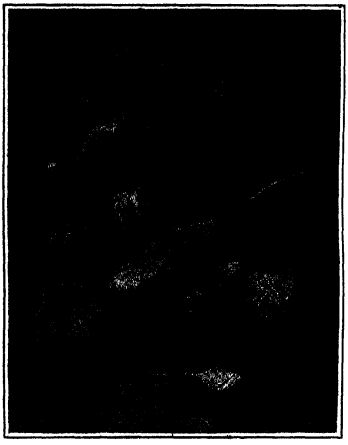
But while the colossal proportions of the group may be lost upon him because of the vaster dimensions of the building upon which it is mounted, its singular beauty, symbolising the purpose of the Grand Central station, must surely make the appeal. The station is a modern gateway to a modern city. Like the gateways of old, cut in the walls or fortifications of a city, it seems fitting that it should be topped by a group which visualizes the purpose of the structure which it adorns. The Grand Central terminal is a commercial building, a portal through which multitudes pass to and from the busiest commercial city in the western hemisphere. Hence, it was decided by Messrs. Warren and Wetmore, the architects, that the architectural composition of the station should consist of three great portals crowned by a sculptural group, the whole to stand as a monument to the glory of commerce as typified by Mercury, reinforced by physical and moral energy in the persons of Hercules and Minerva.

The task of carrying out this idea was entrusted to Jules Coutan, who is a member of the French Institute and who is considered by many the greatest decorative sculptor of our time, that is, in work where the human figure is to play an important part in a public monument. After Coutan had completed his preliminary work, the group was executed in stone in this country in about six months. This extraordinary rapidity was attained largely because pneumatic chisels were used by the workmen, and because the plant in which the group was sculptured was furnished with every modern mechanical convenience. Under ordinary conditions it would probably have taken about eighteen months to finish the group.

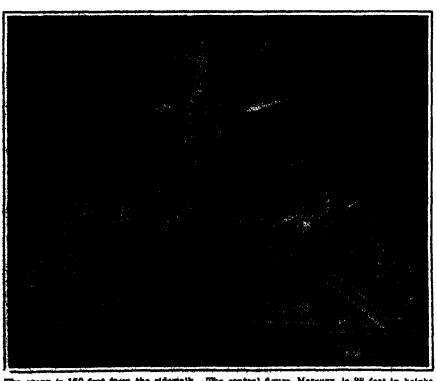
How well M. Coutan has lived up to his high reputation is apparent from the skillful handling of the entire mass as a decorative *motif*. The clock and the human figures above it blend together in a harmonious *ensemble* which is rarely attained in American monuments.



The arm of Mercury is 11 feet long.



The colossal figure of Hercules, one of the three figures in the group which surmounts the clock on the Grand Central station.



The group is 150 feet from the sidewalk. The central figure, Mercury, is 28 feet in height, and the wings of the eagle behind it measure 35 feet from tip to tip.

The heroic sculptural group, designed by Jules Coutan, which crowns the Grand Central terminal station in New York.

Alloys Developing Hydrogen by Contact with Water

IN these days of ballooning, the rapid and cheap manufacture of hydrogen gas is of great importance; and even processes which do not effect the desired result on a commercial paying basis may be of use in directing experimenters toward profitable lines of research, or from those which would prove useless.

Among other processes, there is one by which a considerable number of metals develop hydrogen when in contact with acidulated water; the oxygen set free at the same time being lost. This process, however, has not the advantage of those in which electrolysis is employed, and which permit collecting the oxygen at the same time as the hydrogen.

But now there comes to the front a process, discovered by a Japanese named Sadamasa Uyeno, in Tokyo, by which a certain alloy, plunged in hot water, develops hydrogen from this latter at the rate of 1,200 to 1,500 cubic centimeters at atmospheric pressure to one gramme of this metal. A practical mixture for this purpose consists of 40 parts by weight of aluminium, 7 of zinc and 3 of tin; or to put it in percentages, 80, 14, and 6. The aluminium is melted in a crucible, which is then removed from the fire; the zinc and tin are added simultaneously, and all well mixed; upon which the alloy is cast into suitable slabs.

As the melting points of zinc and tin are lower than that of aluminium, and the alkalinity of these two metals are comparatively small in comparison with that of the aluminium, it is not necessary to put the crucible a second time in the fire, as the newly added metals melt immediately. Thus there is comparatively little oxidation and evaporation of the metals. This mixture is marked *A*. An amalgam of zinc and tin with mercury is made, a slight heat being employed; and this is called *B*.

For every part by weight of alloy *A*, 0.12 to 0.025 part of mercury, or a quantity of the amalgam *B* containing this amount is taken, and well rubbed into the surfaces of the slabs, with a steel brush; thus producing an amalgam on the surface of the slabs. This operation is carried out at a comparatively high temperature, which, however, must not exceed that of the boiling point of mercury (675 deg Fahr., or 352 deg. Cent.). It has been found that the amalgamation of the surface of the slabs by mercury alone is attended with difficulty; when, however, the zinc and tin amalgam is used, there is no trouble. The result is the same in both cases.

The slab with its coating of amalgam is then raised to as high a temperature as possible, in the absence of dampness; care being taken not to evaporate the mercury, and the heating is continued until the amalgamation is complete. This is ascertained by breaking the slab, the process is only complete when the slab is brittle. An other test is to permit the broken-off piece to cool for an instant in the air. If the amalgamation is complete, it will turn black, otherwise it will remain white.

The amalgamating alloy must be kept in a perfectly airtight vessel.

Where cost is an important element in the result, the amounts of mercury and tin (which are the two expensive elements in the matter) may be reduced. If it is a question of rapid development, then the amount of zinc or of tin, or of both, may be increased and that of the aluminium decreased. If quantity is required, the amounts of aluminium and zinc may be decreased.

If it is possible to make this alloy at a price which will permit the manufacture of hydrogen by its use in competition with the present existing processes, it would appear that the acetylene industries would suffer, as there would be absolutely no more danger from the bursting of steel cylinders.

Why a Girdled Tree Can Continue to Grow

TREES are girdled for the purpose of killing them. It has often been observed, however, that not all trees die immediately after they are girdled, but sometimes continue to live for a number of years. This is true particularly with young, thrifty trees having little or no heartwood. Large trees with thin sapwood will die at once if the latter is completely cut through to the heartwood. This can be readily explained on the basis that the heartwood is to all intents and purposes dead, and takes no part in the life of the tree except to support the crown. The sapwood, on the other hand, is the life of the tree, because it serves as the passageway for the sap in its ascent to the leaves. Therefore, as long as the sapwood is not completely chopped through to the heartwood the upward flow of the sap is uninterrupted, and the tree has a fair chance to live for a longer or shorter period after girdling. The sap goes to the leaves, where it is converted by special processes into plant food. As this manufactured food is carried down the stem it passes through the inner bark as far as the wound in the trunk. Above this point growth will be normal, and layers of wood will be deposited in the regular way. The stem below the cut fails to receive nourishment, because a complete ring of bark is removed and the passage of plant food between the leaves and roots is interrupted. Naturally, the tree will die in course of time from lack of sufficient root activity, which is out of proportion to that in the crown. Moreover, the sapwood is becoming narrower every year, and the passage of sap up through the stem is interrupted after it is entirely changed into heartwood.

Compass and Inclinometer for Aeroplanes.—Patent No. 1,097,925, to Henry L. E. Johnson, of Washington, D. C., provides an aeroplane compass and inclinometer for determining the direction, inclination and angle of the aeroplane.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

WARDROBE FIXTURE.—J. FORSTER, 458 W 166th St., New York, N Y. This invention relates to hangers or display devices, and has particular reference to means to be applied to the interior of wardrobes for supporting clothing or the like By the term wardrobes as used herein is meant to cover any kind of closet for clothing or the like.

Electrical Devices.

TELEGRAPH REPEATER.—R. T. DAVENPORT, P. O Box 561, Williams, Ariz. This invention pertains to a single line telegraph repeater, and the general objects are to increase the speed of transmission of telegraph signals repeated from one line to another; to improve and simplify the construction of the apparatus so as to be reliable and efficient in use, and to eliminate objectionable features in existing repeaters.

LINE PROTECTOR FOR TELEGRAPH AND TELEPHONE SYSTEMS.—T. GONSALEZ Y SGRASCO, 42 Industria St., Habana, Cuba. This invention relates to protector devices of the spark arrester type for telegraph, telephone or other electric systems, whereby the electric instruments are protected against high voltage charges accompanying thunder storms or other



LINE PROTECTOR FOR TELEGRAPH AND TELEPHONE SYSTEMS.

electric disturbances The general object is to improve and simplify the construction and operation of lightning arresters of that type, including fuse wires or equivalent means so as to be reliable and efficient in use, and so designed that new fuses can be applied, even during the presence of a storm, without danger to the operator.

Of Interest to Farmers.

CHECK ROW PLANTER.—W. B. HAMPTON, 861 Phillips St., Springfield, Mo. Among the principal objects which the present invention has in view is the provision of means for separating the grains to be planted, whereby the same are more easily distributed than by the operation of machines as at present constructed.

PLANTING MACHINE.—L. B. MCNUTT, N Kingsville, Ashtabula County, Ohio This machine relates particularly to machines for planting seeds of various kinds, as for instance, for planting corn, and the object is to provide an improved mechanism for correctly dropping any desired quantity of seed at spaced intervals of any desired length.

SILO PACKER.—G C PARK, Selma, Iowa This invention relates to a means for packing ensilage in silos and more particularly to a construction in which a packer device is suspended in the silo from the roof thereof, and arranged to be rocked vertically by an operator in the silo and to be raised and lowered, as well as turned about a vertical axis in order to variously position the packer elements in the silo.

PLOW.—J E PEARCE, Austin, Tex The present invention refers to plows for bedding and ridging plowed ground, the aim being to provide a construction in which a motor drive is especially adapted, without the necessity of means to pack loose earth in order to obtain the required resistance to the weight and power of the supporting driven wheels

THRESHING MACHINE.—A M. ANDERSON, Moscow, Idaho This invention is an improvement in threshing machines, and the purpose is to provide a machine of the character specified, wherein means is provided for removing the heads from the straw and for husking the grain immediately after the heads are separated

Of General Interest.

SURGICAL APPLIANCE.—M. IVERSEN, 218 E. Main St., Stoughton, Wis This invention relates more particularly to a fountain especially adapted for use in douching, and characterized by a construction to permit the flow of a given amount of a fluid in a given time or a large quantity of such fluid for the purpose of giving enemas or constituting a proto lysis apparatus Mr Iversen has invented another surgical appliance in which are a fountain can, a dropper, and a form of tube, the apparatus being characterized by the fact that gases may be returned without affecting the operation thereof.

LEAF OF VACUUM FILTERS FOR CYANID PROCESS.—T. ORTSUKA, 66 Mita Toyosakacho, Shiba, Tokio, Japan. The inventor's object is to improve a defect by the new construction of a cocoa or plain mat used heretofore as a core, in which the vertical center rods

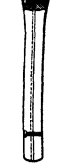


LEAF OF VACUUM FILTERS FOR CYANID PROCESS.

pass through from the bottom suction pipe to the head beam in the center of the leaf to form spaces along the rods for the passage of the liquid, so that the sucking action of the bottom suction pipe is distributed at once uniformly throughout the whole surface of the leaf, and the defective resistance for filtration of liquid is greatly decreased, by which the power of the pump may be greatly saved.

Hardware and Tools.

WIRE SPLICER.—H. B. BOTTEN, Marshalltown, Iowa. The purpose in this case is to provide a device especially adapted for use in weaving fences of wire, or in any other con-



WIRE SPLICER.

dition where it is desired to twist two wires together, wherein a twisting mechanism is provided for engaging the wires, so arranged that one wire will be held firmly while the other is twisted around the same, and wherein means is provided for automatically locking the twisted wire in position operated by the insertion of the wire.

WIRE LINE CLAMP.—J. H. KUHNS, Tulsa, Okla. The object here is to provide a clamp, wherein mechanism is provided for engaging the line at any desired point, and so firmly and rigidly, that the desired amount of traction may be made upon the clamp to draw the wire, without slipping of the clamp.

PIPE AND BOLT PULLER.—O. HENDRICKSON, Pinewood, Florida. The invention relates to a tool consisting of a handle member and a foot of an angle thereto, the latter being provided with gripping means for engagement with the pipe or other article to be pulled, the



IMPROVED PIPE AND BOLT PULLER.

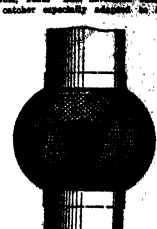
tool being rockable on the heel of the foot, to exert a lifting pull on the pipe. The invention provides a novel arrangement of gripping dogs so mounted as to exert an end thrust against a solid portion of the tool, provision being made for movement of the dogs for the engagement and release of the article to be pulled.

Heating and Lighting.

LOCKABLE COCK FOR GAS METERS.—E. A. C SCHOOF, care of M. C. Berger, 475 Flushing Ave., Astoria, New York, N. Y. This invention has for its general object to improve and simplify the construction and operation of lockable cocks so as to be reliable and efficient in use, comparatively inexpensive to manufacture, practically tamperproof and yet easily manipulated and controlled by authorized persons

ELECTRIC LIGHT PENDANT.—W. O. TRASDALE, care of Bureau of Public Works, Manila, Philippine Islands. The invention relates to improvements in adjustable electric light fixtures An object is to provide a holder for an electric lamp by means of which the lamp may be easily adjusted to any position, and may be firmly held in the adjusted position.

DUST CATCHER FOR AIR PIPES.—C. W. YOUNG, care of A. Gehn, 338 W. Vance Ave., Memphis, Tenn. This invention relates to a dust catcher especially adapted for its inter-



DUST CATCHER FOR AIR PIPES.

posed in an air conductor pipe of a hot air furnace at any point between the furnace and the register. It provides a dust catcher adapted to be conveniently placed in position in any way to be readily accessible for the cleaning of the dust-catching material when desired.

Household Utilities.

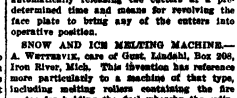
DOOR FASTENER.—T. C. DOSSMANN, 1011 Marengo St., New Orleans, La. This device includes a shank provided with a locking head shaped at one side to project into and be accommodated in the door lock adjacent to the beveled end of the usual latch bolt, the head of the opposite side having a number to be projected laterally into the usual hole in the strike plate on the jamb by the turning of the device, there being a shoulder to engage the strike plate. Means provide for preventing surreptitious turning of the device out of engagement with the strike plate.

STAND.—N. NYBERG, Box 866, Miami, Ariz. This invention relates particularly to a stand in which the support is mounted to turn about the standard, and having a swivel connection with the latter to assume various angles with respect to the horisontal, or to be partially inverted for reading in a reclining position, or to be turned over completely if desired.

WINDOW.—P. L. RICHARDS and A. H. SHULL, Farmington, Minn. By means of this invention, the ordinary window frame, when originally constructed, may be modified at the outer portion to receive the storm sashes or screens, or in the case of window frames already in position, or made up conventionally, may be provided with an auxiliary frame to receive the interchangeable storm sashes and screens.

Machines and Mechanical Devices.

BOLT THREADING MACHINE.—C. VALB and T. C. MUNDY, 604 9th Ave., S.W., Roanoke, Va. This invention provides a device by means of which articles such as bolts may be accurately and quickly threaded. It also provides



BOLT THREADING MACHINE.

means for threading bolts comprising a revolvable face plate having cutters with means for automatically releasing the cutters at a predetermined time and means for revolving the face plate to bring any of the cutters into operative position.

SNOW AND ICE MELTING MACHINE.—A. WETTERVIK, care of Gust. Lindahl, Box 206, Iron River, Mich. This invention has reference more particularly to a machine of that type, including melting rollers containing the fire grates for holding the fuel whereby the cylindrical surface of the roller is heated for melting the snow and ice by direct contact therewith.

LIFTING JACK.—J. P. RENNINGER, Logansport, Ind. This invention pertains to lifting and has particular reference to lifting jacks of the screw type and adapted to be operated especially by power motors for lifting heavy weights such as locomotives and cars for the removal of wheels and trucks.

REMOVABLE VALVE FOR PUMPS.—C. W. HAWKINS, Bellport, N. Y. This inventor provides a pump with a removable valve, the valve being normally held in place in the case of the pump by bolts, connecting the skive with the core, straps being mounted on the bolts, and engaging the valve, and legs which extend from the core for preventing the pivotal movement of the valve relatively to the core.

Pertaining to Recreation.

MINIATURE PARACHUTE.—M. [illegible] OLIN, 414 Union St., Brooklyn, N. Y. [illegible] vention provides a device with a [illegible] in which a loosely mounted weight [illegible] tioned so as to guide the parachute in [illegible] ward travel and also its downward [illegible] also provides a collapsible canopy and [illegible] lar member connected therewith and [illegible] with braces connected with the [illegible] the canopy so as to limit the spreading of [illegible] canopy in its downward movement.

TOY CAR.—F. H. SAGE, 906 So. [illegible] St., Winchester, Va. In the present [illegible] invention is a toy car having internal [illegible] wheels adapted to run on a single [illegible] or rail, and whose center of gravity [illegible] such wheels, so that the car is self-[illegible]

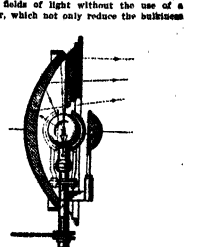
Prime Movers and Their Accessories.

CARBURETER.—D. MC RA LIVINGSTON, 28 E. 32nd St., New York, N. Y. The [illegible] invention provides an ample feed for low [illegible] suree, and prevents excessive feed or too rich a mixture, in response to increase of engine speed. Air inlets are provided in the nozzle at different levels, the inlets being liquid [illegible] under low pressures by the fuel, and admitting at successive heights in response to increased speed, whereby to successively admit into the nozzle relatively increasing quantities of air.

SELF-GRINDING VALVE.—W. MABOUF, Hamilton, Ontario, Canada. This invention relates particularly to the valves of internal combustion engines and of the type generally known as puppet valves, having rotatable and longitudinally movable stems mounted in parallelism, it being the object to so mount the valve stems by gearing that they may be longitudinally moved by the usual cam tappets and rotation applied to one thereof will be communicated throughout the series.

Pertaining to Vehicles.

PROJECTING LAMP.—C. A. MATHIAS and A. C. MATHIAS, 511 E. 116th St., New York, N. Y. This invention relates to projecting lamps on vehicles for road illumination, and has reference more particularly to the type using a mirror lens. It provides a lamp of small depth and weight having two distinct brilliant fields of light without the use of a condenser, which not only reduce the bulkiness



PROJECTING LAMP.

of the lamp, but increase the lighting capacity of the same, as no light is absorbed by the condenser. One of the distinct fields of light can be eliminated when the same is in use in cities. All the above objects are obtained by providing a mirror lens, the reflecting surface of which has the shape of a paraboloid with a source of light positioned substantially in the focus of the said reflecting surface.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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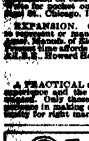
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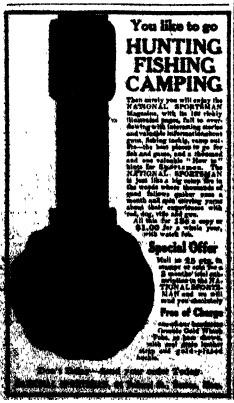
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Strategic Moves of the War

(Continued from page 332.)

boycki, and Lierre were reduced and were captured about October 5th by the assaults of the German columns under the protection of this fire. A lull in the attack then occurred, apparently to enable the Germans to move their heavy ordnance to the east. Next Forts Kessel and Broechem were similarly captured about October 7th, and the Germans advanced against the inner line.

The final abandonment of Antwerp by the Belgian garrison on October 9th seems to have been due to the admission of the French and British of their inability to render any appreciable aid. A garrison of determined fighters could probably have held the fortress for sixty days against the German attack; but the Belgian force, weakened in morale by defeats and by misfortunes apparently due to treason, had choice only of two alternatives. They could remain in Antwerp and suffer a siege with the certainty of capture before relief could come, or they could evacuate the city and save a part of their army to reinforce those of the Allies.

After consultation with their Allies they chose the latter, and they are now fighting in the effort to join the main line of the Allies on the French border. The Germans are making just as vigorous efforts to prevent this. From Lille and Ypres they are fighting to cut off the Belgians from the coast roads, while the victors at Antwerp are pressing hard on the Belgian rear.

The capture of Antwerp is a very great advantage to the Germans. It relieves them of the threatening force on their flank that constantly endangered their line of communication; it shortens their general line of battle and allows them to hold it in greater strength; and it allows them to send the Antwerp army and part of the garrison of Belgium to reinforce their armies at the front. In prisoners, straggliers, and detachments interned in Holland, the Allies have lost at least 80,000 men, while the Germans have lost only the men killed or seriously wounded in the assaults. The capture of Antwerp means for the Germans more than a reinforcement of 80,000 men.

The week has been one of serious reverses for the Russian cause. In the north they have made slight gains and have occupied Lyck, while the northern flanks of the two armies are fighting at Wirballen, where the railroad from Kovno to Koenigsberg crosses the border.

The important fighting has been in southwest Poland, where the Germans have made an advance that influences the whole eastern campaign. When their General Staff saw that the army of Gen. von Hindenburg from East Prussia had succeeded in forcing the Russians back to the Niemen River they turned their attention to the question of relieving the hard-pressed Austrian army at Tarnow. Gen. von Hindenburg was directed to keep up his attacks on Gen. Rennenkampff's army, while the remaining German reserves were concentrated in western Poland to carry out their strategic move. The Russians discovered this projected attack and rushed troops toward Kielce and Tomaszow, but were unable to check the German advance. The former were forced back to Radom and Opatow, due south of Warsaw, where they received reinforcements and made a stand against the advancing Germans on October 6th.

Neither side has given out the details of this battle, but it was evidently a serious reverse for the Russians, who, though probably superior in numbers, were so decisively defeated that they abandoned southwest Poland to the Germans and retreated to the Vistula River. So much was the army in Poland broken up that the Russians had to abandon the important campaign against the Austrians in order to call in troops from Galicia to aid in checking the German advance.

The advance of the Germans was pressed toward the junction of the San and the Vistula rivers and so threatened the communications of the Russian army at Tarnow that it had to fall back rapidly. On October 9th the Russians evacuated



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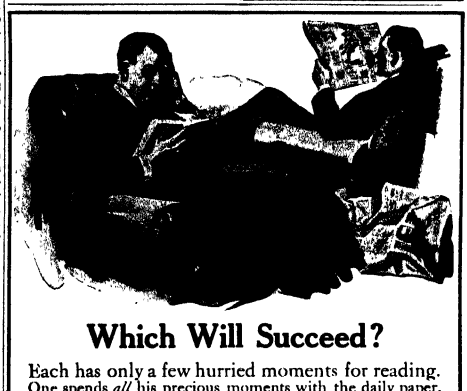


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Hrubieszow, and on the 12th their investment of Przemysl was broken. By this strategic move against the Russian rear, the Germans have accomplished in ten days more than could have been gained by a month of frontal fighting. Besides occupying Poland and forcing the evacuation of part of Galicia, they have gained a respite for the Austrians that will enable them to reorganize their armies.

By successful strategic control of their armies, the Germans have succeeded in pushing a wedge into Poland south of Warsaw, where they threaten to get between the two wings of the Russian army. The difficulties of this advance must have been serious and expensive in men and animals. They had only one railroad to aid them and but few paved roads for their automobile service.

In their new position the Russians should have every advantage in numbers and equipment. If they cannot stop the Germans in the battle that is raging they will be in danger of losing Warsaw.

A computation of resources and time for development of military strength indicates that the Russians appreciably outnumber the combined German and Austrians in this entire eastern theater of operations. The approximate strength of the armies at the front is 2,000,000 Russians against 2,000,000 Germans and Austrians. Success in battle, however, depends upon more than numbers, as was shown by the campaign of the Japanese in Manchuria in 1904 and 1905, when they successively forced superior numbers of Russians to retreat from Liaoyang and from Mukden.

The victory at the point of fighting depends not upon the total strength of the opposing armies, but in the strength that they are able to get into the fight, and the ability of the commanding generals. The commanding general has little information of the enemy's plans, and most of his information is inaccurate. He must guess the plans of his opponents and must make his dispositions to defeat them. The efficiency of his organization also counts greatly; he must be able to put every man possible into the firing line, and yet be able to get them back in hand to be moved to another position if required by the development of the battle. This is where thorough training and practice in maneuvers count in the chances of the army for victory.

Our 8,000 Islands

ACCORDING to a report recently received by the National Geographical Society the United States now owns exactly 8,000 islands, supporting a population of 10,000,000. The report further shows that the commerce of these islands exceeds $300,000,000, or more than that of the United States in any year prior to 1850. American capital invested in the islands aggregates approximately $400,000,000, and from them there is shipped to the United States $100,000,000 worth of products every year, and they take in exchange products of about equal value.

The feature of the report is the development of Porto Rico, Hawaii, and the Alaskan Islands. There were 25,000 pupils enrolled in the first year of American administration, now there are 175,000. Production of sugar has grown from 65,000 tons a year to 365,000. Foreign commerce was about $20,000,000 a year; now it is nearly $100,000,00.

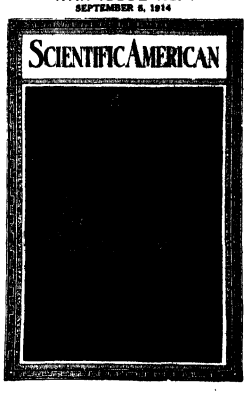
Hawaii has been extremely prosperous since it came permanently under the American flag in 1900. The assessed value of the sugar crop more than doubled, deposits in banks trebled, and in savings banks quadrupled. Hawaii's irrigation system is the marvel of the engineering world, and the quantity of sugar produced per acre far exceeds that of any other spot on the globe.

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You are carried with the Germans in their march through Belgium, in Gerald Morgan's article in the November METROPOLITAN. You feel, with him, the state of mind in Brussels. You see, with him, the events leading up to the destruction of Louvain—and the final burning of the city. For Morgan *was there*—and his account is sincere and graphic. Read the November

METROPOLITAN

"The Lowest Magazine in America"

In "Honor and Arms," a short story by H. D. Lawrence, you gain a timely insight into the relation of private to officer in the German Army.

Then there's a mystery yarn by G. K. Chesterton, past master of thrills; the continuation of "Angela's Business," the new novel by the author of "Queed" and "V.V's Eyes." Other contributors to this unusually good issue are Booth Tarkington, James Keeley, Inez Haynes Gillmore and Art Young.

John Reed's First War Story is in this number—the writer of whom Kipling said: "His Mexico stuff was literature—I read every word of it."

A Highly Humorous Yarn

is "The Cook and the Captain Bold," by John Reed, in November METROPOLITAN. Just imagine a man who takes a correspondence course in seamanship and graduates with the "degree" of Captain; then enlists as a cook, saves the ship and—would you believe it—becomes the Captain! Love stories, too, if you wish. In fact, the November issue abounds in

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THE CENTURY

for the Coming Year

will be essentially a magazine with a world horizon—its keynote, sincerity; its aim, to follow the frontiers of Human Progress. For this reason, it will announce no formal program at this time. Present plans, however, include

Four important fiction serials in large instalments

including James Lane Allen's "The Sword of Youth," beginning in November, and Jean Webster's new novel, the study of a flirt, by the author of "Daddy-Long-Legs," to begin early in 1915.

War News and THE CENTURY

THE CENTURY MAGAZINE, beginning with the November number, will interpret to its readers what lies back of the bare facts of bulletin and despatch. A notable group of CENTURY contributors is already engaged on this important work

In New York W MORGAN SHUSTER and SAMUEL P ORTH of Cornell will write of the war and its effects from an ethnic and political point of view

JAMES DAVENPORT WHELPLEY, now in London, will deal with the personalities of the war lords and the spirit of the nations

ESTELLE LOOMIS, the brilliant short story writer, now in Paris, will be sending THE CENTURY sketches of vivid human interest.

ALBERT BIGELOW PAINE, now in Switzerland, has put himself in touch with the German authorities with a view to presenting views of Germany in war time

DR HENDRIK VAN LOON, historian and journalist, has gone to his native land, Holland, where he will write of the Lowlands in war time

ALBERT EDWARDS, the well-known novelist and travel writer, is to leave for Europe in the near future with a roving commission from THE CENTURY MAGAZINE. His mission is to help build the literature that will grow out of the war itself

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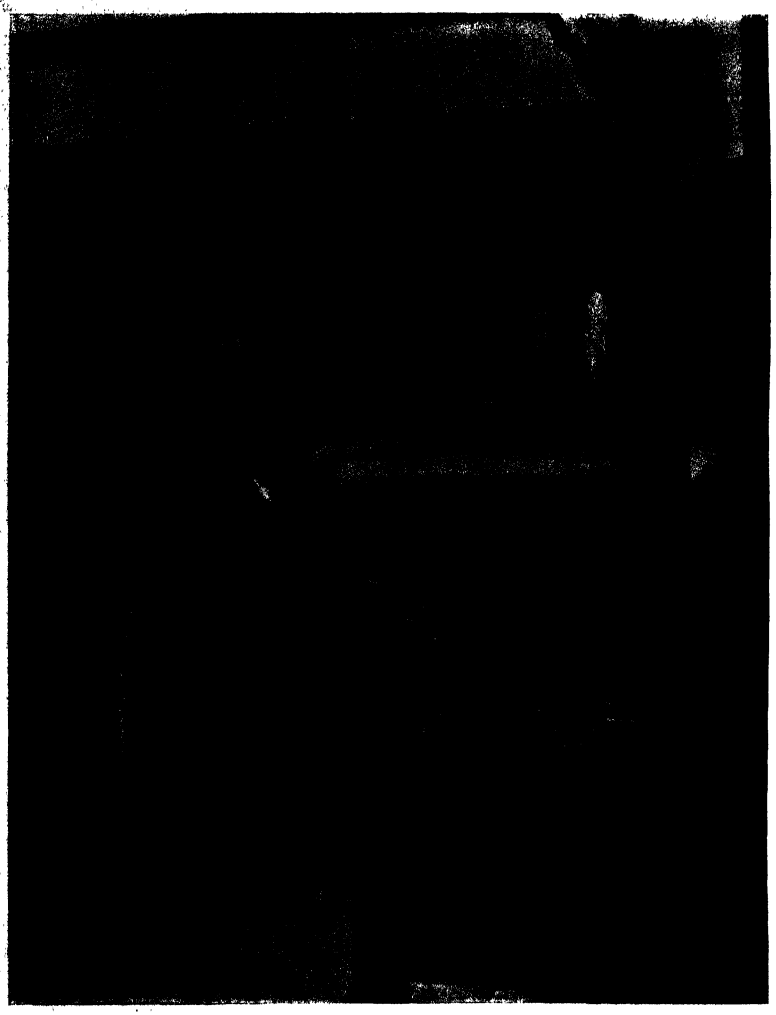
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SCIENTIFIC AMERICAN



CARRYING ON A SIXTY-TWO MILE CONVERSATION BY WIRELESS TELEPHONY.—[See page 352.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Value of Speed—in the Right Ships

A STRIKING lesson of the naval war is the great value of high speed. If it be found in the proper kind of ship. The first demonstration of its value was the escape of the battle-cruiser "Goeben" and the scout-cruiser "Breslau," whose speed carried them, apparently unscathed, through nearly the whole length of the Mediterranean Sea, although its waters were alive with the powerful ships of the Allies. Had these ships possessed less than the twenty-eight knots speed which saved them from the guns of the enemy, they would be to-day somewhere at the bottom of the Mediterranean, as it is, they are afloat, probably intact, and, if reports may be believed, now form part of the Turkish fleet. If so, and should the Turks join the Dual Alliance, these two ships must be counted in as part of the Turkish naval fighting forces.

The United States Navy possesses not a single high-speed battle-cruiser. Our naval constructors are fully alive to the strategical and tactical value of high speed in heavily armed and armored ships, but in common with the whole of the technical and advisory staff of the Navy, they realize that, until our battleship strength has been brought up to the proper stage, it is best to build battleships whose heavy armor will enable them to fight it out to the end in a line-of-battle engagement, rather than more lightly armored battle cruisers, which, through severe penetration of belt or turret armor, might be driven out of the line of battle.

By way of illustrating the value of high speed in capital ships of the first fighting line, let us indulge in a few moments of imaginary strategy and tactics. Let us suppose that, on learning through his Zeppelin scouts that Admiral Jellicoe had sent a large portion of his battleship fleet south to the English Channel, to assist, let us say, in repelling the right flank of the German advance into France, Admiral Tirpitz decided to issue in full strength into the North Sea and make a dash by way of the north coast of Scotland for a raid upon the northern French coast, or for some other objective. (It is unlikely that he will attempt any such thing, but for the purpose of our present argument we will suppose that he might do so.)

Now, because of the fact that the German ships would pass into the North Sea fresh from drydock, and therefore with clean bottoms and in first-class condition, the average speed of its sixteen dreadnoughts might well be assumed at from 20 to 21 knots. The British fleet, because of its having had to keep the sea continuously, in readiness to meet the German fleet should it venture forth, would be found with the bottoms of its ships more or less foul. The average speed of the fleet would be reduced to that of its slowest ship, and due to dirty bottoms, etc., might not exceed 18 to 19 knots.

Immediately on discerning the smoke of the outcoming German fleet, the patrol and scouting ships (destroyers, old cruisers, etc.) would notify the commander-in-chief at his mine-protected base at the mouth of the Wash, let us say, or in the estuary of the Humber. Let us suppose that, directed by wireless, the fleet converges upon that of the Germans, and that, in the stern chase which follows, the rear of the German line is beyond the range of the guns of the leading British ships. The Germans, as we have seen, would have an advantage of a knot or two of speed, and they would draw steadily away, Admiral Tirpitz deciding not to accept battle with the disadvantage of sixteen ships of the line against twenty or more.

Now it would be under conditions like these that the high speed of 28 knots, possessed by battle-cruisers of the "Lion" and "Queen Mary" type and the speed of 25 knots of the battleship "Queen Elizabeth" and class, would prove of incalculable value; for Admiral Jellicoe would send forward half a dozen of these faster units to concentrate their attack upon the rearmost ships of the German fleet. In order to save his rear from being overwhelmed by the concentrated fire of the enemy's 13.4-inch guns, Admiral Tirpitz would be forced to slow down and accept a general engagement. It has been stated in the British naval journals (and we believe it to be a fact) that the object of giving the dreadnoughts of the "Queen Elizabeth" class the high speed of 25 knots, is principally this object of forcing a fleeing enemy to accept a general engagement.

In no phase of the naval war has the value of high speed been more forcibly demonstrated than in the work of commerce destroying, as carried out by the fast German scout cruisers which have been operating successfully in all the seven seas. These ships and their field of operations are as follows:

The "Karlsruhe," 28 knots, and the "Dresden," 24 knots, in the Atlantic; the "Nurnburg," 24 knots, and the "Leipzig," 23 knots, in the Pacific; the "Emden," 25 knots, in the Indian Ocean; and the "Koenigsberg," 23.5 knots, in South African waters. These vessels vary in displacement from 4,900 tons to 3,400 tons. The "Karlsruhe" is protected by a 4-inch belt and carries twelve 4.1-inch guns. The others are protected cruisers, with a 2-inch deck, and they all have a similar battery of ten 4.1-inch guns. From the very outset of the war the British and French cruisers, of less speed but much greater gun power, have been seeking to bring them to action and sink them. Several times one or other of the German ships has been surprised and has made a running fight of it, and, in every case, they have been able to get away, apparently without vital damage. Seemingly they are being coaled by ships which meet them by appointment at specified localities, and now and again they are able to stock up from a captured collier. It is the old story of the "Alabama" on a larger scale; and it is conceivable that the speed of these fast boats may enable them to continue their depredations, uncaptured, until the end of the war.

The Navy Wants Dirigibles

SIX years ago the United States made its first and only experiment with dirigible balloons; when the Signal Corps of the Army purchased the U. S. Dirigible No. 1 from its builder, Capt. Thomas Baldwin. Since that time the only aviation work of the Government has been with spherical balloons and aeroplanes. A year ago the Board of Navy Aeronautics, of which Capt. Washington I. Chambers, U. S. N., was chairman, recommended the purchase of dirigible balloons for navy work. In furtherance of these plans, the Navy Department, through Capt. Mark L. Bristol, in charge of navy aeronautics, has asked eight American manufacturers of balloons and aeronautical apparatus what they can do toward furnishing the United States with dirigibles. The Navy is considering the purchase of at least two such, of a minimum displacement of 75,000 cubic feet. The Navy is firmly of the opinion that airships can be manufactured as well here as abroad. But the Navy also believes that, for lack of experience and facilities, there is not at present any design of airship in this country suitable for naval purpose.

The Navy Department has asked American manufacturers if they will undertake to obtain plans, specifications, and the rights to manufacture one or two airships for the Navy. The Parseval, Astra-Torres, Clement-Bayard, and Forlonini types are all favorably considered by the Navy. It has asked if manufacturers will submit estimates for supplying one airship of one or more of the above types, the plans and specifications to be of the latest type abroad, and the manufacture to be in this country; also a second estimate for two of the same type, and a third for two of different types. Manufacturers may submit estimates for any other types than those herein mentioned.

Questioned about the proposed airships, Capt. Bristol said that if airships prove successful in the present war in Europe, there will probably be a demand for several for our Navy in the near future. He stated that the one or two airships immediately required are for the training of personnel and to gain experiment for future development of them. This is the reason a small size is considered. For regular service, airships of 100,000 cubic feet displacement or over will be required.

It is impossible to say whether such airships will be used from a ship as a base. It is certainly possible to fly a dirigible from a ship, especially if it is made for the purpose. Whether it is advisable, or whether it will be considered necessary, we do not know and cannot state.

Capt. Bristol said he knew that the navy would welcome the opportunity to buy a number of dirigibles of the right kind, made in America. He says the [illegible] appropriation, and the Navy would have had [illegible] long ago, had we had the men to manufacture [illegible] here. He feels that we need some experimental ships for training men before we go deeply into the matter. You can't pick a man up off the street and make an airship operator of him in a day. He must be trained, and well trained. The first airships [illegible] will be for training men and for experiment. The only experience this country has had to [illegible] is that of the Army dirigible, and that was [illegible] in the light of present day's experience, for [illegible] tion now.

The U. S. Dirigible No. 1, of 20,000 cubic [illegible] ity and 19.3 knots speed on test, was a mere [illegible] light of the subsequent developments of the [illegible] and the Parseval. Capt. Bristol is emphatic in [illegible] statement that he does not want American manufacturers to consider that the Navy wants another [illegible] merely because it wants airships for experimental [illegible] and man training. Indeed, the statement that a [illegible] mum of 75,000 cubic feet displacement is wanted, in the proposed specifications to be submitted, is evidence of that. Of course, a bag with even 100,000 cubic feet displacement is small compared to some dirigibles, such as the Zeppelin, with its upwards of 500,000 cubic feet displacement. But a dirigible of 100,000 cubic feet displacement will train men as well as a larger one, and its manufacture should afford its maker such valuable experience that subsequent attempts would be even more successful.

The Navy wants dirigibles, and is willing to pay for them; more, it is willing to enter into any reasonable arrangement which will assist manufacturers to give the Navy what it wants. There has been a great deal of talk in the trade journals devoted to aeronautics about the apathy of the Government in this department of modern progress. The war abroad is focusing attention of everyone everywhere upon the airship and the aeroplane and is emphasizing the small resources of the United States in these aids to offense and defense. Here is an opportunity: among the 100,000,000 people of the United States, surely there are a few who will be encouraged to co-operate with the Government in the development of this arm of the service.

Naval Co-operation With the Allied Land Forces

THE latest demonstration of the great value of the command of the sea was the co-operation of the British fleet with the allied forces forming the extreme left flank of the Allies in Belgian territory. According to a statement issued by the Secretary of the Admiralty, requests for naval assistance were made by the allied commanders. In response to this a naval flotilla, mounting a large number of powerful, long-range guns, came into action off the Belgian coast in support of the left of the Belgian army, the gun fire being directed against the right of the German attack, which the ships, due to their position, were enabled to enfilade. The report states that the Germans replied with shells from their heavy guns, but that, owing to the superior range of the British naval artillery, practically no serious damage was done to the ships.

An interesting feature of these operations was the presence in the British attacking fleet of three monitors, the "Javary," the "Madeira," and the "Solimoes," which were building in England for Brazil, and were taken over at the outbreak of the war. These vessels, judging from their dimensions, etc., are true monitors, of the type developed during our Civil War. They are 265 feet in length, 49 feet in breadth, and draw 4½ feet, with a displacement of 1,250 tons. They mount two 6-inch high-velocity rifles and two 4.7-inch howitzers. Their speed is 11½ knots.

It is not stated whether the attacking fleet included any capital ships of large size, mounting the heaviest guns. If any of the older battleships were included, the German right must have been subjected to the fire of 35- to 40-caliber 12-inch guns. These pieces have a maximum angle of elevation of 15 degrees as mounted in their turrets, at which elevation their maximum effective range would be, say, from ten to twelve miles. The gun fire was directed by observation from captive balloons, and under the guidance of the observers, it would be possible, by alteration of elevation or by reducing the powder charge, to cover many miles of the German front with a destructive 12-inch shrapnel fire.

A New Altitude Record by an Army Aviator.—Using one of the army scout biplanes with a 90 horse-power motor Capt. H. L. Muller of the First Aeroplane Corps of the Army bettered by 2,008 feet, on October 9th, the record of 15,137 feet made with a gyrostabilized Dunstetter by DeLloyd Thompson at Kansas City. The new record is 17,440 feet, while the world's [illegible] record is 26,240.

Electricity

Automatic Electric Lighter for Gas Stove.—A patent, No. 1,176,660, has been issued to Leroy B. Jewett of Lyons, Iowa, in which a valve must be moved beyond full open position to close the electric circuit for lighting the gas of a gas stove, the valve being returned to full open position for normal use, thus making sure that there will be sufficient gas to be lighted and at the same time avoiding the necessity of making the circuit when the gas is on or off.

Wireless Telephony for Moving Trains.—For many years, J. J. Millener, experimental engineer of the Union Pacific Railway, has been working on wireless telephone apparatus for direct communication with moving trains. He announces that his plans have been completed and a satisfactory system has been developed, whereby he is able to talk with a moving train a hundred miles away from the wireless transmitting station. Wireless stations are to be established at Grand Island and North Platte, Neb., Cheyenne and Green River, Wyo., and Ogden, Utah.

Fire Fighting with Fans.—The use of electric fans by a fire department in putting out a blaze is surely novel. In Boston not long ago a fire broke out in the basement of a building occupied by a wholesale paint and chemical concern. The fumes and smoke became so thick that it was impossible for the firemen to enter the basement. A half dozen of the ordinary sixteen inch size electric fans were quickly requisitioned by the fire chief and their breeze directed down the stairway. As soon as the rear basement windows were broken to allow the escape of the smoke and fumes, the effect of the fans gradually cleared the basement, so that the firemen could work quickly and effectively in extinguishing the flames.

Atmospheric Electricity over the Ocean.—A report on the atmospheric-electric observations made during the second cruise of the "Carnegie" is published by C. W. Hewlett in *Terrestrial Magnetism and Atmospheric Electricity*, and constitutes an important contribution to the study of electrical conditions at sea, as the observations cover a period of more than two years, and were made on the Pacific, Atlantic, and Indian Oceans. Combining the results with those obtained by other observers, it may be stated that the potential gradient is of the same order of magnitude over the sea as over the land; the radioactivity of the air over the ocean areas far removed from land is small, compared to that found over land; while the ionization over the ocean is at least as large as that found over land. The specific conductivity of the atmosphere is found to be independent of its radioactivity. The mean value of the specific conductivity given by the "Carnegie" observations was 3.07×10^{-4} E. S. U., which is larger than the mean value found over land.

New Method of Adjusting a Detector.—An English wireless operator is making use of a method for adjusting contact between crystals in the detector which he claims is an excellent one. In this case the contact between two crystals is obtained, not by hand, but by the use of an electromagnet which produces the pressure and can be given a very fine adjustment. One crystal cup is mounted on the base of the apparatus, and above it the second cup lies on the end of a short vertical slide arm, placed on the end of a rather long tongue or spring strip. Midway on the tongue is an iron armature which can be drawn down by an electromagnet on the base. A rough adjustment is made by sliding the top crystal in its screw slide and fixing it, then current is put on the magnet so as to draw down the spring blade and so adjust the contact between the top and bottom crystals. A rheostat of the sliding kind is used to give a close adjustment of the current.

Air Gap Measures.—A point which is often very useful to know but at the same time difficult to find out by convenient means is the strength of the magnetic field in a dynamo or motor in the air gap between armature and field. After a machine has been built, it is important to know whether this strength corresponds with what was given in the theoretical design. In order to take the strength of this field by direct measurement, Messrs. Morphy and Oschwald had the idea of inserting a small bore test tube into the narrow air gap. Inside this tube is a long armature of rod shape, pivoted at each end, and carrying a wire coil. A hair spring is mounted so as to work with it. When a current is sent in the pivoted coil this reacts with the lines of force in the air gap and causes the coil to pivot about to a certain angle depending on the strength of the magnetic field, there being a constant current sent in the coil. On the enlarged outer end or handle of the exploring rod is a mirror which turns with the coil and throws a spot of light on a graduated scale. This scale is carried on a swinging arm so as to fix some distance off and can be adjusted. The lamp is mounted at the outer end of the arm and sends the beam down upon the mirror, whence it is reflected upon the scale in the usual manner. By swinging the arm around it can be brought to bear upon any part of the air gap and the field strength may be very quickly observed.

Science

The Carothers Observatory at Houston, Texas, reports a new method for observing sun-spots without the aid of a telescope, as follows: If images of the sun be formed through clean-cut round holes of proper size in a darkened room at sufficient distance from the aperture and cast upon clean white paper or cardboard, sun-spots of ordinary size may be readily seen on the image. This method would enable amateurs to note the progress of the spots across the solar disk, and if daily drawings be made the result would soon be a delightfully interesting record.

Inks where it is damp or chemical fumes are present it is usually difficult to cause labels to stick to bottles or cans. An ink for use on such containers is made as follows: shellac 20 grammes, dissolve it in a hot solution of borax containing 30 grammes of borax to 400 cubic centimeters of water, filter while hot and add a solution made of aniline black, 8 grammes, tannin 0.3 gramme, picric acid 0.1 gramme, and ammonia 15 grammes, in water 10 grammes. It will be found that this ink works nicely and resists the usual chemical and corrodive fumes.

The Influence of X-Rays on the Propagation of Sound.—The theoretical deductions of Boltzmann and Maxwell on the constitution of gases lead to certain conclusions respecting the rate of proportion of sound waves through gases. For the most part gases obey these theoretical laws, but oxygen presents anomalies. This departure from the normal behavior of gases on the part of oxygen was attributed by Richard to the neutral ionization of the gas, and consequently a systematic study has been made by Kupper on the influence of various ionizators on the velocity of sound in various gases. On submitting atmospheric air, oxygen and nitrogen to the action of X-rays, the velocity of sound propagation through those gases is greatly increased. The ultra-violet rays from a quartz mercury vapor lamp give rise, in the case of oxygen and of mixtures containing oxygen, to the formation of ozone and in consequence to a reduction in the velocity of sound. In the case of nitrogen and hydrogen the velocities are increased, although not to the same extent as when X-rays are employed. The rays of radium exert no appreciable effect, and neither do the variations produced by an alternating electric field.

Gems in Ultra-Violet Light.—Recent experiments made with vacuum tubes and ultra-violet light bring out the fact that the diamond, ruby and emerald, as well as certain minerals such as kinzigite, have surprising fluorescent properties. In rarefied air, certain diamonds emit a blue fluorescent light resembling what sulphate of quinine gives under the same circumstances, and *in vacuo* a diamond of 4 or 5 carats is stated to give a luminous effect which is equal to 20 candle-power. The ruby gives a fine red phosphorescent light, while the emerald produces a crimson light. It is also observed that the mineral kinzigite emits a yellow radiation, sometimes tinged with rose color. The same stones are found to glow with phosphorescent light when exposed to the action of radium. Experts are now able to make use of these properties of gems or other minerals in order to estimate the value of certain stones, for instance, the Burma ruby can be compared with the Siam ruby, the former being much more valuable. When examined by usual light it is hard to detect a difference between the two gems, but when exposed to ultra-violet light the Burma ruby glows with a red light like a hot coal, while the Siam variety remains almost black. Such a method is likely to prove valuable for the lapidary and also in mineralogical work.

Edward J. Hall, Telephone Pioneer.—Edward J. Hall, vice-president of the American Telephone and Telegraph Company and chairman of the Executive Committee of the Western Union Telegraph Company, who died recently, was one of the pioneers of the telephone business. Mr. Hall was the son of Edward J. Hall, a Perth Amboy manufacturer, and was born March 31st, 1853. Later the family removed to Buffalo, and the son graduated from the Yale Scientific School in 1873. Appreciating the possibilities of the telephone, Mr. Hall secured the right to operate in Buffalo from the parent Bell Company in 1878, and organized a telephone company, of which he became vice-president and general manager. When, on January 1st, 1885, Theodore N. Vail, then general manager of the American Telephone Company, was developing the project to organize the American Telephone and Telegraph Company, he asked Mr. Hall to take charge of the development of the new system. At that time the development of long-distance telephone lines was still in its infancy, but Mr. Hall saw the possibilities in the development of this branch of the service and undertook to carry it out on a large scale. On January 1st, 1887, under Mr. Hall's direction, the line from New York to Philadelphia was opened to the public. Mr. Hall married Louise Winne in Buffalo, who survives him, with two daughters and a son. His home was at Morristown, N. J. Mr. Hall was a director in a number of telephone and manufacturing enterprises and a member of several clubs.

Aeronautics

Our Military Aeroplane Competition Called Off.—Owing to the failure of the competitors to submit the proper plans and specifications, the Government competition for tractor biplanes was called off on October 22nd. Three of the eleven entrants appeared, while a fourth machine had been shipped from New York. The competition will probably be held at a later date.

The Value of Aeroplanes in War.—In all of his reports Gen. French has laid stress upon the great service rendered by the aviators in ascertaining the moves of the enemy as soon as they start to make them. The reconnaissance work they have performed has been invaluable. According to the official statement of the British War Office, their aviators are covering an average of 2,000 miles a day. Up to September 21st they had flown 87,000 miles and remained 1,400 hours in the air. By now these figures have been doubled. A certain French corps commander's opinion is that a single aeroplane is as valuable as an entire division of cavalry.

A New American Cross-country Record.—Since the European war began there has been no aviation news in the United States as far as actual flying is concerned. We are therefore doubly pleased to be able to record the addition of 140 miles to the distance across-country scored by C. Murvin Wood on August 9th of last year, when he flew from Hempstead, L. I., to Gaithersburg, Md., near Washington, D. C. The new record—365 miles—was made by W. C. Robinson, the well known Wright and Nieuport pilot of Grinnell, Ia. He flew from Des Moines, Ia., to Kentland, Ind. He intended to fly direct to Chicago, but was driven off his course by a storm. The flight was made in a new monoplane of Robinson's own construction.

Directing Gun Fire by Means of Aeroplanes.—An Associated Press despatch published in most of the New York newspapers states that the German aviators have been directing the artillery fire about Mons. This is exactly what military experts expected. It will be remembered that during the Russian Japanese war the eminence known as "203 meter hill" was captured and recaptured again and again by both Russians and Japanese, finally to remain in the hands of the Japanese. The hill was wanted not to plant guns on it, but simply to enable a man with a telescope to direct the fire of the Russian battleships on Port Arthur. An aeroplane would now perform the same function much more effectively and, of course, with little or no loss of life.

Daring Raids of British Airmen.—The long-distance flights of leading German aviators, headed by Lieut. von Heidesen, to Paris, and the sudden appearance of their machines, from which manifestos and bombs were dropped, above the capital city as well as over Antwerp, Ostend, and Dunkirk, was offset and greatly surpassed in the amount of damage done by two raids made upon Dusseldorf and Cologne by British airmen. The first of these was made on September 23rd by a squadron of the Royal Naval Air Service consisting of five machines led by Lieut. C. E. Collett. In a thick mist they set out from Antwerp for the above mentioned places situated well over 100 miles within the enemy's country. After dropping a few bombs on Maestricht, Holland, by mistake, the aviators reached Dusseldorf and Cologne and dropped the rest. At Dusseldorf they succeeded in damaging a Zeppelin shed and its airship, as well as a machine shop near by. The aviators returned to their starting point unharmed. Their appearance had been so sudden and unexpected that they were fired upon scarcely at all. No such raid by a number of machines appears to have been made by the Germans, although they possess easily three times as many aeroplanes as the English.

Destruction of Zeppelins by British Aviators.—The second raid on Dusseldorf and Cologne—the first had resulted in the flying of large white flags from the cathedrals at Cologne, Strassburg, and other cities along the Rhine, as well as of bigger Red Cross flags on the hospitals—was made by the three machines of Lieuts. R. L. G. Marix, Sidney V. Sippe, and Spencer Grey, which left Antwerp on October 8th shortly before the bombardment of that city began. Lieut. Marix did the most damage and had a marvelous escape. The 100-mile trip across country was made at a height of a mile. As soon as he was over Dusseldorf, Lieut. Marix sighted the Zeppelin shed and swooped down to within 500 feet of it, dropping a couple of bombs at the end of the long volplane. He was subjected to a heavy rifle fire and a stream of bullets from Maxim guns. One bullet passed through his cap and one of the twin control wires of his elevator was severed; but he managed to fly away and return to Antwerp. An explosion and sheet of flame right after he dropped the bombs apprised him that he had hit the shed and blown up the airship inside. It was first claimed this was an old Parseval, but confirmation was had later that one, and perhaps two, Zeppelins were destroyed. The other two aeroplanes came down before they reached home, but the pilots descended within the Allies' lines.

Letters from the Firing Line

Traits of the French Soldier

By Aide-de-Camp Xavier Sager, Special Correspondent of the SCIENTIFIC AMERICAN at the Front

THE day after the victory of the Marne Gen. Joffre, commander-in-chief of the French army, wrote this sentence, which, though concise, is very full of military meaning: "The government of the Republic may well be proud of the army that it created."

During the two months that Germany has been throwing forward the great weight of her formidable masses, which to-day we have beaten back, there has hardly been a day when I was not closely associated with one or more of the different classes of soldiers composing the French army. I have seen them on duty; I have heard their conversations. I have slept on the hard ground with them, I have shared their bread, and what I would like to tell the world to-day in these few notes which I have jotted down at haphazard is the true worth, both physical and moral, of the French soldier.

What distinguishes him above all else is his full realization of the part he has to act. The German is a good soldier as far as discipline is concerned, for this has been deeply instilled into him; but in a certain way it is a passive kind of a discipline—he lacks, in consequence, individual initiative. Nothing is expected of him but obedience. We have a proof of this every moment. For instance, in the encounters with the patrol, if the German officer happens to be killed, the men who, when under his command, had fought courageously, surrender immediately. This is not a lack of courage on their part; but left to themselves they become immediately demoralized and do not know what to do.

It is entirely different with the French. Before everything else, each soldier feels himself a free citizen who has voluntarily taken arms for the defense of those ideas of justice and liberty which he has inherited from his ancestors. For these reasons he gives to his country the full measure of his intelligence and his courage. From this point of view the French army is very truly a "nations in arms."

Nothing is more picturesque, more typical than a French cantonment. Here all social differences have entirely disappeared. There are no rich, no poor, no peasants, and no society men. Here absolute equality reigns. One soul animates them all—the soul of the soldier. A little while ago some one remarked to me that the German is a soldier by education, but the Frenchman is a soldier by nature. That is perfectly true. I met the other day, in a cantonment near Chalons, a young professor of the Sorbonne, a very erudite lecturer, elegant and popular in Parisian society, now a simple soldier of the second class, who had just finished carrying water for the troops. Here I saw this young *savant*, who was always so elegant in his appearance and manner, his cap over his ear, singing at the top of his lungs with his comrades a song that would make a brigadier blush.

A few days in the field had transformed him, or rather had been sufficient to awaken in him the military instinct which slumbers in the depths of the heart of every Frenchman, even the most cultivated and peace-loving. I have seen also some poets who had broken with poetry, some diplomats, some inventors, some priests, some actors, all animated with the same high spirit, all having forgotten their past positions to become exclusively soldiers, and handling guns, pickaxes, and the pots and pans of the army kitchen as if they had never done anything else. This fraternity, this comradeship, does not exist only between equals. This fact immediately strikes everyone who comes into the French lines. The subordinates accept their superior willingly, because there is no social hierarchy; there is only a hierarchy of competence. From this it is easily understood how authority can be reconciled with the most cordial comradeship, all are friends without allowing discipline to suffer in the least. We know that this is not the case in the German army. The German officer belongs to a superior caste, which in no circumstances whatever can mingle with the common soldiers. With us a lieutenant or a captain is perfectly willing to sleep on the straw by the side of his men, and he will not refuse to drink a few swallows of wine or coffee from the gourd of a simple trooper. On the other hand, a Prussian lieutenant considers himself dishonored by the mere touch of one of the men under his command, whom he often treats as if he were a valet devoid of dignity, and indeed he often gives him a kick or a slap.

I saw the other day in a railroad station a German captain, who was a prisoner, demanding some water from the French sergeant in charge of him. The latter handed him his cup, which he had previously rinsed with the greatest care. The officer threw away the water in disgust. Such behavior greatly concerned this good sergeant, who thought he had done the proper thing. But a French general who was there had seen the occurrence. He approached the sergeant, and slapping him on the shoulder, "It is very warm," he said. "I should like to have a drink." Meanwhile he looked fixedly at the Bavarian officer, who reddened as the general slowly emptied the tin cup. I call attention to this trait, because I was one of the few witnesses, and because it is characteristic of the very different ways in which the officers of the two armies treat their men. Moreover, as a general rule, such haughty manners is of no avail in the presence of the French trooper. Their proud behavior, their arrogant attitude, and their contemptuous words miss their aim.

A few days ago, after an engagement with a German patrol, a zouave captured a young German lieutenant wearing a monocle. As he started back toward the French lines the officer, thinking that the soldier was walking too close to him, and did not keep a respectful distance, moved away with no attempt to disguise his repugnance. But the zouave was so little intimidated that he said: "Too bad for mademoiselle; wait a minute." Then he made him carry his knapsack and all his equipment, crowning his head with his porringer (*camelle*). It was a somewhat crude joke, for which the zouave was reprimanded; but this proves at least how little the German officer knows regarding the mentality of the French soldier.

"We have just accomplished a colossal sport. All world's records have been smashed, and notably that of the 200 meters, in plowed-up fields, with knapsack on the back. I believe that André (André is the athletic champion of 1914) could not have done better. It is after having accomplished this remarkable performance that I received in my left arm an impertinent bullet. We were charging at full speed, regardless of the shells which were whistling their funny little tunes around our heads, and we would have succeeded if it had not been for those devils of Bavarians who were keeping their ground with the energy of desperation. I already held one at the point of my bayonet when a sudden blow made me lose hold of my gun. Carried away by the impetus I had time, before I fell, to deliver a formidable 'direct from the right' upon the corner of the jaw of a tall imbecile who seemed to be laughing at me. Then I kind of lost the notion of things.

"I came to in the arms of a giant, a fellow of the chorister section of the opera, who had picked me up and carried me in the ambulance, while he was howling in a formidable voice: '*Arrachons Guillaume à ses fers*' (let us tear William from his chains). As you are a musician you might know that this is from the opera of 'William Tell.' We have here a basso who used to sing in Lyons, he spends all the morning in taking care of our *poilards*—pardon, I mean our bayonets. He is all right, but his voice is enough out of pitch to put in flight a whole regiment of the Parisian guards. Amen. You see that my spirits are good. I desire only one thing, and it is to get well as soon as possible to begin again fighting the enemy."

The cavalryman loves his horse as much as the artilleryman loves his cannon. In the battle of Epernay a battery of 75 was suddenly surrounded by a German division. After a desperate resistance our chief judged it necessary to call his men back. The artillerymen carried away with them the breech (*culasse*) of their cannons, which later on they had to abandon with cries of rage, for all the horses had been killed. They wanted a revenge and they did not have to wait very long to get it. That very evening, during a charge with the bayonet, we saw the four pieces of 75 which had been put together in a farm under cover of a barn, and were guarded by a dozen or so of German soldiers. We did not lose time in deciding what to do. Fifteen artillerymen swore that they would take their cannons back. When night came these men crawled unseen through the intrenchment of the enemy, and reached the spot where the Germans had placed our pieces. Two of the artillerymen sprang on the sentries in charge of watching the farm; taken by surprise, according to our plan, they were killed, without having time to utter a cry. At midnight the fifteen men returned to the camp with our precious 75.

The French aviators do not seek publicity, they do not try to attract upon themselves the attention of the civilians by such inglorious feats as to throw bombs on open towns and kill the women and children.

However, the *avion* is the king of the modern battles. It is with its invaluable help that we have been able to win all our victories. Of course at the beginning we were somewhat surprised—Germany had organized her aerial fleet in such a marvelous and quick manner. The aviators were more numerous than we had supposed. On our side we utilized, without delay, our scanty fleet in the air, and in a short while it rendered exceptional services to our *état major*. It has played a decisive part in the battle of the Marne, and every day we find it to be an invaluable auxiliary, an indispensable help to the march of our armies. Every day we witness some magnificent and thrilling feats upon the part of the aviators. For instance, the *sang-froid* of this lieutenant whose motor stopped working when he was just reaching the camp of the enemy. He would not fail to his death without having accomplished his mission, and putting his machine to volplane he threw his projectile with perfect accuracy. There is nothing in ancient history which surpasses or even equals such courage. Imagine the cold heroism of this man, sitting up there in the clouds, almost immobile in his darting machine. And this man is able to tell himself quietly: "If I see an *avion* enemy I dash straight upon it." His hand was as steady as his heart and his eye clear, his only care was to make his voluntary death bring the maximum of service to his country.

The hatred which exists between the two fighting armies is ferocious. I cannot keep from my memory the horrible picture which I saw one evening in a village. After having repulsed the enemy we entered one of the abandoned houses. In a narrow corridor I saw two soldiers, one French and the other German; both had pierced each other at the same time with their bayonets. They had met face to face in this dark hall, and with the same action they had impaled each other. Death had taken them there, both standing up imprisoned between the two walls of the narrow passage, united by the thrust that had killed them.

To finish, I wish to relate the story of this brave French officer, who in a sharp fight discovered a Prussian officer hidden behind a locomotive. The two men looked at each other, and with one accord they walked fifteen steps away and took position for a duel. "Shoot," said the Frenchman. The German obeyed, but missed his aim. The Frenchman then lifted his arm, and his adversary fell pierced with a bullet.

I believe sincerely that even our enemy cannot deny the value of the French soldier. Indeed, the fault of our troops is an excess of courage. When riding through the forests our cavalry even refuse to deaden the noise of the horses' hoofs by riding on the grassy side of the road. They sing, they laugh, they gallop.

This war is a war of a new kind, where the events succeed each other with a great unexampled rapidity—it is the effort of whole nations.

Oh! The dash of our men rushing to the fight! The magnificent determination of those who, each day, go to fill up the gaps; the heroism of the families bearing their anguish and mourning their dead.

Those men are the flower of France, who scorn all danger, and who rush toward death for the honor of the flag and of the country.

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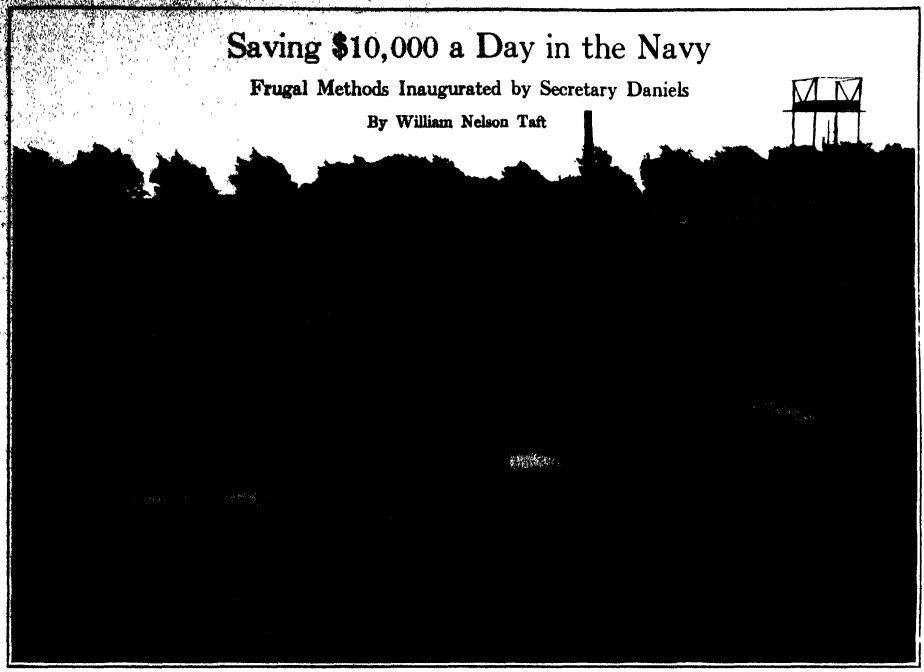
Progress of Agricultural Education in America

DURING the past ten years the number of students taking the full four-year course in agriculture in American agricultural colleges has increased from about 2,500 to 12,500, or 500 per cent. The number of white students registered in short or special courses has doubled in the same period, amounting now to about 11,000. Since 1910 the yearly number of graduates in agriculture has increased from 708 to 1,884, and the number receiving advanced degrees from 74 to 164. The aggregate revenues of the land-grant colleges have about tripled, while those of the experiment stations have more than tripled. The men on the staffs of the experiment stations have increased from about 700 to about 1,600, and the number of those doing no teaching from 375 to 925. An especially notable development of the last decade has been the growth of agricultural instruction in secondary schools. In 1908 very few secondary schools gave such instruction, while at present over 2,000 do so. Remarkable progress is also to be noted in agricultural extension work, outside of that carried on in farmers' institutes. There are now 1,300 men employed as state, district and country agents, and as boys' and girls' club workers. The operations of the Smith-Lever Act will greatly increase this class of work. The above figures are quoted from a recent address by Dr. A. C. True, director of the United States Office of Experiment Stations.

Saving $10,000 a Day in the Navy

Frugal Methods Inaugurated by Secretary Daniels

By William Nelson Taft



Economy in the Navy Department.

How the scrap iron at the Philadelphia Navy Yard is segregated and piled, so as to get the best possible price from purchasers

BY careful business management and attention to details in administration the Navy Department saved the Government of the United States $3,156,677 in the fiscal year which ended June 30th, 1914. In other words the Department has saved a trifle over $10,000 for each of the 310 working days comprised within the official year! The books of the Navy Department for the first fiscal year of the Daniels administration show the following clear savings:

Projectiles	$1,107,860
Battleship No. 39	795,394
Food, clothing, and other supplies	500,000
Scrap metal (except copper)	300,000
Copper reclaimed	150,000
Requisitions	143,423
Colliers with fleet	75,000
Transportation of men and materials	50,000
Channel at Mare Island, Cal.	35,000
Total	$3,156,677

Government officials have but a single answer for this phenomenal reduction in the running expenses of the Navy Department—"Competition."

Competition was responsible for the cuts in the projectile bids; competition saved the Government nearly $800,000 on the cost of a single battleship; competition reduced the cost of feeding and clothing the men of the Navy by a clean half-million. Competition, in short, saved the Government $10,000 a day!

Shortly after taking office Secretary of the Navy Daniels was convinced that the Government was being mulcted by the bidders for naval supplies. He was not able at the moment to put his finger on the exact spot where the loss occurred, but a little quiet investigation assured him that the so-called "competition" among bidders was nothing more than a farce which the Government paid a good price to witness. In explaining the situation as he found it, the Secretary of the Navy said:

"Theoretically, in conformity with an Act of Congress, the Department advertises generally for bids on armor-plate. Theoretically, the information that the Department wishes a large quantity of armor-plate is spread throughout the length and breadth of the land in order that every manufacturer may bid. Theoretically, no competitor is allowed to bid who is engaged in any combination to keep up prices. When the bids are received they are opened, and it is, I believe, the general impression that the lowest bidder in what has been an open contest receives the award of the contract.

"Now let us see what was actually done in the case of the contracts for 8,000 tons of armor-plate to be used on the new battleship "Pennsylvania," which will cost the Government in the neighborhood of $3,500,000

"The advertisement for this contract actually appeared in one notice, an inch long, in the Philadelphia *Item*. The advertisement read 'Sealed proposals for furnishing armor for vessels will be received at the Navy Department at noon, February 18th.' No hint of the amount or quality of plate desired was given and bids were received from three plants—the Carnegie Steel Company, the Midvale Steel Company, and the Bethlehem Steel Company.

"Each of these bids was accompanied by the usual affidavits, required by Act of Congress, that the company submitting the bid was not in combination with any other company, and that there had been no collusion in the determination of the prices named.

"It would be natural to suppose that the lowest bidder would receive the award. But such was not the case. On the theory that all three companies must be encouraged to maintain their armor-plate departments, the contract was arbitrarily divided among them at the price bid by the lowest firm!

"This has long been the established custom of the Department, and can hardly be said to be an inducement to any one of the competing companies to bid the lowest possible price. Under the circumstances, I am surprised at the moderation of the bids, because I do not see that anything but modesty or the fear of a Congressional investigation kept them from putting their lowest price at, say, $700 a ton.

"This practice was not confined to armor-plate, by any means. I have met it in practically every field of contract bids. Probably the most striking instance was when I examined bids for two complete conning towers, submitted by the Midvale and Bethlehem Steel Companies and accompanied by the usual affidavits that the companies were not in any combination. Despite this fact, and the collateral one that they were supposed to have worked on independent sets of figures, the two companies had arrived at precisely the same bid of $43,062!"

It was consideration of these facts that led Secretary Daniels widely to advertise for special treatment steel plates for Battleship 39 (as yet unnamed), and the contract was finally awarded to the Carbon Steel Company of Pittsburgh, which bid for 3,900 tons at $187.04 a ton.

The last previous purchase of similar material was made in December, 1910, when 1,000 tons were bought from the Carnegie Steel Company at $294.03 a ton. The saving on the "Battleship 39" contract, therefore, amounted to $106.99 a ton, or about 36 per cent of the previous price, with a total saving of $378,291.

After advertising for bids on the armor-plate for the same battleship and again receiving three identical estimates, Secretary Daniels requested a conference with the representatives of the three big steel companies "with a view to learning by what process of mental telepathy they had arrived at the identical figures in their bids."

After this conference the Secretary of the Navy said: "The identical bids of the three great steel companies speak more eloquently than any explanations which may be offered. They prove conclusively that 'competition' for this enormous amount of Government business is a farce." The three bids were ordered thrown out and the contract was re-advertised.

Upon receipt of the new figures it was found that the Midvale Steel Company had cut its original price $14 a ton on all classes of armor, and the entire contract was awarded to this company at a saving to the Government of $111,875

Letting the contract for the turbine rotary drums for "Battleship 39" to the Cyclops Steel and Iron Works of Sheffield, England, saved the Government $102,836 more. The bid of the British firm was only $57,436 as against $160,368 and $160,272 bid by the American companies—a saving of 65 per cent on this single item.

But even greater than all the economy practised with regard to the construction of "Battleship 39" was the saving effected in connection with the award of contracts for projectiles to be used by the Navy during the present year. By enforcing free and open competition with respect to contracts for these shells, the

(Concluded on page 357.)

Strategic Moves of the War

Letter from the Military Correspondent of the Scientific American, October 24th, 1914

The Campaign in France.

THE capture of Antwerp freed for the Germans the army of Gen. von Beseler that had been engaged in this attack, and enabled them to undertake the next step of their campaign. The assaults against the lines of the Allies at Roye, Lassigny, and Rheims had shown that further attacks on the center would have little chance of success. Accordingly, they made their effort on the northern flank, where neither side yet had sufficient troops to occupy continuous fortified lines.

The Germans followed close behind the fleeing Belgians, but seem to have sent part of the Antwerp army to reinforce that of Gen. von Boehn at Lille. In the effort to render aid to the Belgians, the British sent troops from France toward Ostend and were unprepared when the German blow fell. The attack was expected along the coast from Ostend, but the main German advance was made from Lille. The British resistance was overcome and their line was forced back, as given in one report, to a point between Hazebrouck and St. Omer.

The French line held firm at Arras and the British-Belgian force held back the Germans on the east at the Yser River. When reinforcements enabled the British to check the German columns near St. Omer, the latter found themselves threatened on three sides and had to beat a hasty retreat. In following up this move the British recaptured Estaires and Armentieres and forced the Germans back to Lille. This thirty-mile advance and retreat had left the lines with little change in their relative positions.

The great German campaign for the capture of Dunkirk had failed, though, and the Allies had shown their fighting ability under adverse circumstances. The result could not but be of considerable encouragement to them, especially so since the forces in this field were reserves and volunteers whose conduct under fire was until then untested.

The Allies are still fighting, not so much to win, as to keep from getting badly beaten in these first days of the war. Their full strength cannot be developed before next spring, so they are well satisfied with an even break at present. So much have the Prussian successes, against Austria in 1866 and against France in 1870, impressed the military men of all countries that the whole strategy of the Allies has been directed to avoiding a knockout blow in the first rounds. If they can force the combat to settle down to a question of endurance, there can be but one outcome. In the beginning Germany's well-trained and well-equipped men can outfight largely superior numbers of their opponents. But before August comes again the Allies will be able to outclass them not only in numbers but also in armament, ammunition, and the accessories that add so largely to the fighting power of troops.

By the addition of the small remainder of the Belgian army and by the arrival of a new volunteer army from England the Allies have been able to strengthen their northern flank. Their entrenched line now extends to the North Sea near Nieuport at the mouth of the Lys River. For 300 miles, from the coast to the Vosges Mountains at St. Die, the two forces oppose each other along lines strengthened by firing trenches, bombproof shelters, redoubts, and every form of earthwork. Any frontal assaults will be driven back with enormous loss unless the fire of the defenders can be prevented. Yet these are the tactics that are apparently going to determine the outcome of the great battle in France.

The main weight of the German attacks has fallen in two places. In the north their move against Dunkirk seems to have been defeated, but in the south their attacks on the forts of the Meuse continue with increased energy. The French claim that these have been repulsed, but the success of the Germans in maintaining their advanced position at St. Mihiel indicates that they have achieved some other successes in this region.

Meanwhile the French are making a slow advance from the south that is bringing the German line into a dangerous position. By occupying Apremont, due east of St. Mihiel, and Pagny, further to the east on the Moselle River, the French have advanced to within ten miles of the German line of communications. This ten miles, though, includes the barrier of the German entrenched line; much hard fighting will be required before the supremacy in this field is settled.

Tactics of Frontal Assaults.

This is the first war in the world's history in which assaults on entrenched positions have had to be carried out over such a frontage, and the necessity of such tactics has largely increased the importance of artillery. So great has been the improvement in this arm that a battery can put out of action any troops in open ground on which it can deliver fire. The defense against this arm must come either from concealment or from silencing the enemy's fire.

When an attack against the enemy's line is planned every preparation must be made before the troops are moved. By aerial reconnaissance the hostile artillery and the dispositions of the enemy's forces are located. Then the troops for the assaulting columns and the guns for their support are moved by night to positions opposite the point of attack. Every provision must be made to conceal the move from the enemy's scouts and to keep the new troops under cover all of the succeeding day.

Meanwhile the officers reconnoiter the fields over which they are to make the advance. During the succeeding night the assaulting columns move to their positions and the guns are trained, some on the enemy's artillery and some on the infantry trenches. The columns then start the advance. At the first sign of discovery by the enemy of the approaching attack the artillery lets loose its storm of shrapnel in the effort to cripple the opposing guns and to force the hostile infantry to keep under shelter. Under this protection the infantry advances until the leading line is within 400 yards, a quarter of a mile, of the trenches.

Their own field guns must then change their fire to some target other than the trenches for fear of shooting up their own men. The assailants consequently are dependent upon their own efforts for the further prosecution of their attack, and to accomplish this it is essential that the opponents be prevented from delivering an unopposed rifle fire. This is accomplished by allowing only half of the charging line to advance at a time. While one half keeps up the rifle fire that keeps the enemy from massing his parapets in full force, the other half rises and rushes forward thirty to fifty yards. In this way by successive partial advances by rushes, the line is worked up close to the enemy's trenches. But here the wire entanglements and other obstacles are encountered, and costly delay ensues while they are being removed. This accomplished, the line moves forward again until the enemy's defenses are reached, and the question is settled by hand to hand fighting with the bayonet.

More often the assault is checked before it reaches its object. Then the men take advantage of any slight depression and dig for all that they are worth. Twenty minutes' work will give them protection from rifle fire, while an hour's digging will give a deep narrow trench furnishing shelter from shrapnel fire. In this case the trenchwork is continued throughout the night, and also during the succeeding days until the advanced position thus gained is strongly defended.

In case the ground gained cannot be held the retreat is carried out similarly to the advance, one half firing while the other retires. The artillery in this case also renders valuable service in protecting its own side from the great losses that they would suffer if subjected to the unencumbered fire of the enemy's field guns.

The Russian Campaign.

In the campaign in Russia the fighting along the East Prussian boundary has come almost to a standstill during the week. The Russian attacks pushed the Germans back to Lyck in Prussia and Wirbalien in Russia, but here the German defense stiffened and has held the Russians back. It is probable that the Russian attacks have also been weakened by the necessity of rushing troops to the south for the defense of Warsaw.

In the campaign in Poland the Germans accomplished their two great strategic objects of relieving pressure on the sorely-tried Austrian forces and of carrying the war into the enemy's country. The momentum of their advance carried them up to the gates of Warsaw. Repulsed here, they recoiled upon their forces to the rear just as a stretched rubber band will draw back to normal shape.

This is a quality of military operations as of many other forms of activity. An aggressive policy adds the energy of motion to the inherent strength, or potential energy, of the actual numbers. The Commentaries of Napoleon aptly express this in the words, "The strength of an army, like power in mechanics, is estimated by multiplying the mass by the rapidity; a rapid march augments the *morale* of an army, and increases all the chances of victory." But if the active move be checked this advantage passes and the ordinary factors of numbers, equipment, and training determine the superiority.

The recoil from the attack on Warsaw has carried the Germans back thirty miles, but in the south they have maintained their advanced position and are disputing with the Russians the possession of the crossings of the Vistula River in its upper stretches near the Galician border. This is where they join with the Austrians, and it is by attacks in combined strength on this part of the Russian line that they hope to break through and to force the further retirement of the Russian forces in Galicia.

The Austrians have followed closely behind the retreating Russians and have shown an energy that gives proof of the important gain secured by the German cooperation. By the reverses in the north the Russians have been forced to call in their cavalry divisions from Hungary and to concentrate every effort on holding the positions along the Vistula and San rivers while waiting for further reinforcements to reach the front.

In the control, supply, and reinforcement of their lines the Russians have a considerable advantage. In their rear they have the five undamaged railways in Russia and the three repaired lines in Galicia. Both the Germans and Austrians have advanced over districts in which the railways have been recently destroyed. They cannot yet be fully repaired, while the continual rains make the country roads almost impassable. Russian mud bids fair to defeat the German invasion, as it did that of its noted predecessor, the great campaign of Napoleon against Moscow in 1812.

Rasmussen's Exploration in Northern Greenland

DETAILS of the remarkable crossing of Greenland by Knud Rasmussen and P. Freuchen in 1912 have been slow in reaching the world, but it has been evident since the first announcement of this feat that it was in many ways unique in the history of polar exploration. The explorers left the Eskimo trading-station "Thule," near Cape York, April 6th, 1912, for the eastern coast. On the outward journey they sledged 650 miles over the inland ice in 165¼ hours, while on the return journey a distance of 830 miles was covered in 175½ hours. Of the fifty-four dogs with which the travelers started, twenty were brought back. It is now learned that another somewhat similar expedition was carried out in 1913, and that the station "Thule" is henceforth to be the base of extensive explorations in northern Greenland, thanks to funds provided for this purpose by a Danish manufacturer named Olsson. It is also reported that Rasmussen will undertake a north polar expedition next summer. In co-operation with the geologist of the American Crocker Land Expedition, which has its base in Etah, Greenland, Rasmussen recently made a study of an immense iron meteorite, found at Cape Melville by Eskimos, and has taken steps to have it transported to Copenhagen.

The Current Supplement

ON the front page of the current SCIENTIFIC AMERICAN SUPPLEMENT, No 2026, for October 31st, is a striking picture of one of the great salmon which are caught in such immense numbers on the west coast of our continent. Comparatively few people realise the magnitude of the salmon canning industry, and the story that accompanies this illustration will be new to readers in many parts of the country. Who knows what life is? This is a question that is being asked by scientists, and their investigations and discussions are interesting the world. The article on the Principles of Biochemistry is a contribution in this direction. The Value of Radium in Surgery is a statement by a leading surgeon of actual results, a sane, authoritative valuation without a trace of visionary sensationalism, and an informative article that will be appreciated by all. The Nodon Electrical Process for the Preservation of Wood is something that should vitally interest every user of that material, as it describes what is claimed to be a perfect process, that can be worked rapidly and cheaply. The valuable article on the Metallurgy of Iron is concluded, as is also the interesting description of the application of the Gyroscope to do the work of the compass, and other wonderful applications. There is also in this issue a wide assortment of articles to meet the taste and interest of all classes of readers.

A Woman Explorer in Arabia

A DARING exploit carried out early this year was Miss Gertrude Lowthian Bell's journey from Damascus to Hail, the Shammar capital, in the heart of Arabia, a place which had not previously been visited by any European since Baron Nolde was there in 1892. From Hail Miss Bell traveled north to Bagdad, and thence across the Syrian desert back to Damascus, after a journey of four and one half months. The principal investigations carried on during the journey were archæological. Miss Bell will describe her experiences before the Royal Geographical Society, in London, December 7th.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Cost of Establishing an Aniline Dyestuff Industry

To the Editor of the SCIENTIFIC AMERICAN:

The quotation of a statement made by Dr. Hesse, which is given on page 302 of your issue of October 10th, in an article on "Coal Tar Dyes," contains a somewhat misleading misprint. The initial outlay involved in the establishment of an aniline dyestuff industry, is estimated, on Dr. Hesse's authority, at $50,000,000. As a matter of fact, Dr. Hesse's statement published in *Metallurgical and Chemical Engineering* is that the initial lump gross outlay for this purpose would be not less than $5,000,000 actual cash. ALFRED J. LOTKA.

New York. General Chemical Company.

Scarcity of Potash Salts.

To the Editor of the SCIENTIFIC AMERICAN:

Noting the statements made concerning the scarcity of potash salts in this country owing to the cutting off of the supply from Germany, I wish to call attention to the possibility of a small supply in connection with our beet sugar industry.

In European countries the so-called "vinasse" from the stills used in treating beet-sugar molasses is treated in such a way as to obtain about ten pounds of crude potash salts to the one hundred pounds of molasses entering the still. These crude materials average from 40 to 70 per cent of potash salts.

It would seem that if the price of potash continues to rise, the production of potash salts from the beet sugar refuse in this country might be profitably carried on. W. B. HARPER.

Montgomery, Ala.

Interesting Shop Kinks

To the Editor of the SCIENTIFIC AMERICAN:

The following might be good to know by many of the readers of your journal.

Among my jobs as machinist once was one of repairing a leaky boiler. In the boiler were about 700 copper flues of ½ inch diameter. After having spent about four successless hours in order to get out one of the flues that had to be replaced with a new one, to me came the idea of threading one end of the flue with a tap, large enough to make a sufficient hold for a bolt or screw, but not so large as to cut through the copper flue. When I had the bolt or screw in the one end of the flue, I unloosened the other end of the flue, put a steel rod through the flue, hit the rod with a hammer, and it took only about a minute to get each of the other faulty flues out of the boiler in my new way of doing it.

Once I was reaming out a new wristpin lining for an air compressor. The reamer was 2¼ inches in diameter, but it was just a trifle too small for making the bore in the lining large enough, so I took a strip of thin copper, such as are used as fuses connected with cables or bars, transmitting electric currents. First I used a strip of the copper, wide enough to cover three of the teeths of the reamer, and let it follow the reamer through the bore, but still the hole was too small. After using another copper strip, covering four of the reamer's teeth, I got a perfect fit for the wristpin.

New York. G. H. ANDER.

Our Foreign Possibilities

To the Editor of the SCIENTIFIC AMERICAN:

There are many things to be done before the United States can permanently secure a foothold in foreign markets. Some of these things have been done. Through the aid of the National Foreign Trade Council our shipping laws have been revised, so that it is economically possible to operate ships under the American flag. The bars which have obstructed American shipping are not yet entirely removed, but we have made great progress. National insurance of the hull and cargo is now an accomplished fact. Next, and of the greatest importance, is that the Sherman Law should be so amended as to exempt export trade. This law was framed, and is enforced, to protect and care for the welfare of American people. The intent of the law is plainly in the interests of the small manufacturer, yet as applied to export trade it seriously interferes with the small manufacturers' opportunity, and nobody wants to pursue any policy in business to-day where there is even a suspicion of infringement of the Sherman Law.

The one sure way to develop export trade is to send live men into foreign countries. Those men should be equipped with a knowledge of the subject and with the proper prices at which the goods can be sold. It is useless for us to try to get our full measure of foreign business through agents, through catalogues, or through correspondence. The value of the business depends upon the value of the man sent to get it, and here is where the small manufacturer is placed at a disadvantage. He cannot afford it, yet the Sherman Law is supposed to be his helper.

Combinations of manufacturers are permitted in most of the large foreign countries. They get together and are even patronized by the Government in their efforts to sell goods abroad. Place the American manufacturers in the same position, or in a position even approaching it, and they will establish themselves.

Foreigners in general look upon America as the most advanced of all countries, the home of inventions, and their ears are open when approached by competent experts who know their business. Good men will see to it that the foreigner is asked to buy from us, and at the same time he should be asked what he has to sell the American manufacturer, because through reciprocative trade the foreigner will be able to pay his bills.

The next important point is to establish banking facilities by means of which goods purchased in foreign countries may be paid for by drafts on New York or other American banks. All other conditions are those that are common to any business house seeking business anywhere in the world. W. L. SAUNDERS,

New York. Ingersoll-Rand Company

Violation of Neutrality Foretold

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of the 12th of September you stated in your editorial the following: " . . . Nothing that Count von Bernstorff or any other apologist of the German breach of good faith may say, can make the American people think that Germany believed France was intending to do that which she herself has done (i. e., violated the neutrality of Belgium)."

On page 148 of John L. Stoddard's Lectures (1898) on Belgium, I accidentally came cross the following the other day:

"It is well understood that this neutrality has been guaranteed by England, France, Russia, Prussia, and Austria; yet from a military standpoint, it is also clear that the powerful armies likely to be organized upon its borders, in case of war, would be compelled to enter in order to secure a position in which to attack each other. . . . Still, notwithstanding the well-known views of England on this subject, and the policy she would be likely to pursue to maintain Belgian neutrality, I recently heard a distinguished European diplomat (German?) say that if war should break out between France and Germany, the neutrality of neither Belgium nor Switzerland would be respected by either of the contending forces; that the violation of neutral rights would be absolutely required by the necessities of the situation; and that the contending armies would undoubtedly be obliged to pass through one or both of the neutral countries, or possibly even to fight on their soil, and Switzerland is fortunate through intervention of Italy."

Even in this far-off integral portion of Uncle Sam we are taking a lively interest in the outcome of this gigantic war, and ere this will reach you, probably in two weeks' time, it is sincerely hoped that Uncle Sam would be successful in arranging for peace, so that the millions of young men now on the battle field, in the armies of each of the powerful contending powers, may be spared the awful doom awaiting them all should this war continue for a year, or even months

KAOAOKALANI

Wailuku, Maui County, Ter. Hawaii

The Revocation of Patents Owned by Belligerents

To the Editor of the SCIENTIFIC AMERICAN:

London cables have informed us lately that England has instituted a boycott against anything made in Germany and that England had declared war against Germany because it had guaranteed the autonomy of Belgium. Inasmuch as the understanding of both Triple Alliance and Triple Entente stipulates that if one of the three was invaded by a foreign foe, the other two should come to its assistance, so England was in the same position as Italy, and if both of those countries had remained neutral, a great deal of the present carnage in Europe would have been avoided.

If England had joined with Germany, as requested, to induce France to remain also neutral, it is more than likely that there would have been no war at all. England's claim that its honor required that it go to war because it had guaranteed Belgian autonomy, is a subterfuge viewed by her past. Simply by the law of force on account of its largest navy, she took Egypt, the Transvaal, Orange Free State, Gibraltar, Cyprus, and India; then she bombarded Alexandria in 1882 and Copenhagen in 1807. Her guarantee did not bother her when she canceled thousands of her guarantees in canceling German and Austrian patents. Belgium was guaranteed by Germany full autonomy; was told that Germany only asked for passage, and Belgium had already allowed French aeroplanes to reach the German border for reconnaissance, and military aeroplanes are as much instruments of war as are cannon.

England, Japan, and the United States have guaranteed the autonomy of China. The Japs are landing, daily, troops in China, and it appears that England offers no protest. In my opinion, the cancellation by England of the many thousands of German and Austrian patents, after the inventors had fully disclosed their inventions to England in good faith, is the crime of the age against the genius of a great people.

Notices in the press would indicate that France, and even Canada, expect to follow England's suit and declare German patents invalid, and in my opinion your most influential publication should vigorously oppose such procedures. Inventions are for the benefit of mankind in general, not for any one single country. If an invention pertaining to instruments of war were canceled, there might be some excuse for that, but not for the cancelation of all patents, and each patent issued by any government implies the guarantee by that government, in return for the disclosure of the invention, the full protection and guarantee of the issuing government. WILLIAM EDENBORN

New Orleans, La

Technical Writing by Non-technical Men

To the Editor of the SCIENTIFIC AMERICAN:

Perhaps a few additional facts may clear up the much discussed question of non-technical writings.

Incorrect pen pictures, artistic or otherwise, distribute false impressions, they may even be harmful, as the widely taught accounts of Mahomet's coffin (said to be magnetically suspended in space!)

No artist's work, on the other hand, is the less valuable for a close adherence to facts. One of the best popular literary accounts of an engineering feat, "The Story of a Lighthouse" (Smeaton's) was written by a trained *engineer*, Dr Du Bois of the Sheffield Scientific School. The notion entertained, and so often sarcastically mentioned, by certain academic "highbrows," that an engineer is synonymous with grime and grease and lack of artistic appreciation, lacks the support of facts. The very engineer who endures the dust and pressure of the task is the one who endeavors to surround his home life with the best that civilization offers.

Whatever may be the excuse offered for inaccurate accounts of engineering work, the real reason appears to be the laziness of the writer; this statement is, of course, not personal. As a result we have the Sunday supplement space fillers, for the newspaper writer seldom has the time for careful inquiry. Instead of associating with the workers or becoming partially familiar with the applied viewpoint, the natural and easier course has been to slur over vague points with the nice phrase and terms which are so plentiful—"Aerial principles governing" to "Zero of the thermometer kind of heat." One reason why we have bulky text books is the "in other words" repetition used by the confused authors to cover up their own deficiencies. Accuracy does not, however, require technical terms and extreme formulation. "Catalysts" means nothing to the average reader. "A contact body which controls a chemical action but is not itself consumed" is better, because it means just what it says. Formulation is all right in a mathematical exposition of "Electric Waves," but when applied to ordinary technical subjects, only results in needless confusion, and referring back to or memory of the whole sentences represented by a single word or symbol. Fortunately, some recent attempts at coining new technical words to cover a whole statement have been distinctly frowned upon, as "jigger" in radio-communication. "Ohm's law gone to seed" may not sound technical, but is the expression used by Prof W. S. Franklin (Lehigh) to startle a body of physics instructors into a realization of the vague explanations still existing in certain text books.

We see, then, that it is not at all a question of who does the writing, for while one technical man makes a mass of one subject, another writer, without technical training, turns out a lucid account of the same matter, or *vice versa*, the man of grease and grime produces the literary as well as the actual masterpieces, while the professional writer goes astray in a mass of fine passages.

Finally, when we consider the mass of effort expended on the well worn, common literary topics, the relatively minor attention directed to technical and industrial achievements is surprising. Compare the few pages which deal with scientific progress, in school books, for instance, with the hundreds of pages devoted to the minor political occurrences of past ages, and you will see that encouragement should be given to every writer, regardless of his technical or non-technical antecedents, who really has something to say about the achievements and improving forces of the world. Common steel and cement, despised sewage, unsensed vibrations—such are the points which may yet form greater masterpieces than were ever made from human blood!

Minneapolis, Minn. PHILIP E. EDELMAN

The Colin-Jeance System of Wireless Telephony

New Apparatus With Which Telephonic Communication Has Been Carried On Over Sixty Miles

By Jacques Boyer

WIRELESS telephony, one of the most remarkable applications of electricity, is the transmission of sounds or spoken words to a distance by means of a microphone at one station and a telephonic receiver at the other, the two instruments being connected, not by a wire, but only by trains of aerial electric waves.

As the tones of the human voice and those of musical instruments involve thousands of vibrations per second, the electric waves employed in wireless telephony must be sustained and of great frequency (80,000 to 100,000 per second) in order to assure uninterrupted transmission, as Blondel has shown. Several experimenters have accomplished this result, by two general methods. In the method first employed high-frequency alternators or rapidly rotating static induction machines were used In order to evade certain practical difficulties Poulsen employed the singing arc This is an electric arc, produced by a direct current dynamo, in the circuit of which inductance coils and a condenser are intercalated. The arc is formed, not in the open air, but in a conducting atmosphere composed of hydrogen and hydrocarbons, similar to illuminating gas. In these conditions electric oscillations, which may number 500,000 per second, are produced in the arc. If the singing arc is employed to excite an antenna indirectly, by induction, the antenna emits sustained waves of great frequency, which are very suitable for the transmission of musical tones and spoken words.

A microphone inserted in the circuit of the antenna impresses the necessary modifications upon the emitted waves, and the sounds are reproduced by a telephone connected with the antenna of the distant station.

A few years ago Capt. Colin and Lieut. Jeance of the French navy made some experiments in wireless telephony between the Eiffel tower and Villejuif, 5 miles distant; then between a warship and a land station 12 miles apart, and finally between two land stations separated by a distance of 62 miles. After these modest beginnings the electricians of the Compagnie Générale Radiotélégraphique, which had constructed the apparatus used by Colin and Jeance made improvements, particularly in the microphone, which had been found unable to sustain very strong currents.

Successful telephonic communication has recently been made between Paris and Voves, a distance of about 62 miles, with the new apparatus, which is briefly described below.

The arc is formed in an atmosphere composed of hydrogen and acetylene, the former obtained from hydrolith (calcium hydride) and the latter from calcium carbide. The two gases are evolved in the same generator, where they are induced to unite by vigorous stirring. The carbureted hydrogen which results from their union passes, at a little more than atmospheric pressure, into a cylinder 6 inches in height and 16 inches in diameter. Three electric arcs, occupying the vertices of an equilateral triangle and connected in series, are placed inside the cylinder, which has two lateral openings One of these openings is covered with red glass and serves as a window through which the arcs may be observed. The other opening is covered with parchment, which serves as a safety valve, and is ruptured in case of an explosion due to the accidental admission of air, which forms an explosive mixture with the other gases.

Each arc is formed between a fixed disk of copper and a rod of carbon 1/25 inch in diameter, so mounted that it can be raised or lowered from the outside by turning a crank The arcs are established by raising the carbons into contact with the copper disk. The carbons are then lowered sufficiently to produce arcs about 1/25 inch long Although the carbon rods, which form the positive electrodes, are gradually consumed, they need no regulators because their waste is compensated by a deposit of carbon produced by the decomposition of the surrounding gas

It is necessary, however, to cool the copper disk by a current of water Each disk forms the bottom of a vertical cylinder filled with petroleum oil and containing a worm through which a steady flow of water is maintained. The water cools the oil, which in turn cools the copper disk. When the part of the disk at which the arc is formed becomes burned it is only necessary to turn the disk slightly by hand in order to present a fresh surface to the electric current In this way a remarkable constancy of the arcs is obtained.

Three arcs are used because the required voltage ($3 \times 110 = 330$) can conveniently be obtained from a feed current varying from 500 to 700 volts, by interposing an adjustable resistance. There is no advantage in increasing the number of arcs and, consequently, the voltage, because the microphone is injured by sparking if the current through it exceeds 0.6 ampere.

The arcs are included in the circuit of a 700-volt dynamo, together with a pair of choking coils which protect the dynamo from high frequency currents, and a variable resistance which prevents short-circuiting and assures the constancy of the arcs.

This circuit, the oscillating circuit, also includes a variable condenser, and the primary coil of an adjustable transformer. The secondary coil of this transformer is not connected directly to the antenna, but forms part of an intermediate circuit, called the filtering circuit, which greatly increases the range, destroys parasitic waves and supplies the antenna with waves of a single and perfectly uniform length.

This transformer, or inductive coupling, is composed of two flat spirals of copper ribbon mounted in frames. One of these frames is fixed, while the other is hinged like a shutter, so that the angle between the planes of the spirals can be regulated easily and quickly. The filtering circuit is coupled with the antenna in a precisely similar manner, and is completed by the intercalation of a variable condenser. The antenna circuit—radiating circuit—includes a condenser and a variable inductance coil, in addition to the resonator, or spiral by which it is coupled with the filtering circuit.

The microphone is composed of nineteen microphone cells, each formed of pulverized carbon pressed by a thin plate of carbon. The cells are arranged on a circular disk, as may be seen in one of the illustrations, and are covered by the mouth of the megaphone which is shown detached in the illustration. One of the turns of the resonator is connected to earth through the microphone. This arrangement eliminates the sputtering noises that are heard when the microphone is inserted directly in the antenna circuit and removes the limitation to the energy supplied to the antenna.

Our frontispiece is a view of the interior of the station, and on the opposite page is a photograph of the operator's table separately. This table is furnished with two microphones and their megaphones, which are used alternately for short periods in order to prevent overheating. The change is made simply and quickly by means of a commutator.

Any receiving circuit can be used, with the aid of the tuning spirals which are seen in the cabinet adjoining the switchboard, on another of the photographs.

In the experiments recently made at the laboratory of the Compagnie Générale Radiotélégraphique, waves from 900 to 1,100 meters in length were employed for transmission. Trumpet calls can be produced at the receiving station, with the aid of a keyboard connected with the oscillating circuit of the sending station.

The Italian scientists, Majorona and Vanni, are endeavoring to increase the range of wireless telephony by utilizing the vibrations of liquid veins. Other pioneers are working in the field, and we may expect to be able, one of these days, to telephone from Paris to New York.

Random Reflections

By "Irresponsible"

OLIVER HEAVISIDE, that great but comparatively little known mathematical genius, has an amusing passage in his "Electro-magnetic Theory," in which he discusses the various names which have been bestowed on the scientific man. "Physicist" he rejects with scorn, and indeed there is something barbarous and journalistic about the sound which renders everyone possessed of a musical ear extremely reluctant to adopt it. "Natural Philosopher" he thinks a very fine name, and remarks that it calls up impressive visions of bald-headed old gentlemen, very much wrapped up about the throat. But, he goes on to say, how can one be a natural philosopher with a Salvation Army band performing joyously, if not most melodiously, just outside the window?

This sense of incongruity between the old-fashioned dignified names of the past and our present hustling, materialistic age must have struck more people than Oliver Heaviside. How is it possible to call Prof. Blatant, that celebrated publicist and diner-out, a natural philosopher? Scientist, or even "expert scientist" is the least we can call him. And those gentlemen of truly encyclopaedic knowledge who write so informatively on "Eating Oysters to Prolong Life," "Should Toe-nails Grow Inward," and "Your Character From the Number of Hairs in Your Eye-leather"—are they natural philosophers? Great are the powers of advertisement.

It is true that we have men living who could carry with dignity the most high-sounding name we choose to bestow upon them. In every corner of the earth where science is pursued the names of these men are known. But what is their fame compared to that of a notorious politician or of a dexterous and indefatigable packer of pork? Henri Poincaré, perhaps the greatest mathematician that ever lived, received, on his death, a few lines lurking in obscure corners of our widely circulated newspapers. But what boots it? He did his work, noble work worthily done, and he left the world the better for his efforts. It cannot matter to such men that the loudness of one's talk impresses the public more than the matter of it; that the man with the most noise obtains a greater hearing than the man of most sense. But it matters to the public. It is time we learnt to distinguish brains from blather.

It is a favorite occupation of mine to read the works of scientific men of the past few centuries. Their results, so far as they are accurate, are in every text-book, and their theories, their ingenious, imaginative, and oftttimes amusing theories, are largely exploded. But what a sweet fragrance and gentle dignity there is about these old books! Take Newton, for instance, discussing the "Propagation of Light." He imagines light to be due to little particles shot out from bodies, and after describing this he goes on, "But they that like not this, may suppose light any other corporeal emanation, or any impulse or motion of any other medium or æthereal spirit diffused through the main body of æther, or what else they can imagine proper for this purpose. To avoid dispute, and make this hypothesis general, let every man here take his fancy; only whatever light be, I suppose it consists of rays differing from one another in contingent circumstances, as bigness, form, or vigor."

Could anything be freer from the spirit of partisanship or more delightfully tolerant? There is a charm about this way of writing which is lost in our modern treatises of deadly rigor.

It would not be difficult to defend the reading of these old books as against the reading of modern treatises. The science you would learn would be all wrong, but what does that matter? I am assuming you are not a professional scientific man. The mental training to be derived from observation and deduction and the rest of the long names which are supposed to constitute scientific method, would be the same. As a matter of fact, the mental training, to say nothing of the mental delight, obtainable from the old books is certainly greater than that which can be got from the modern reasonably elementary treatise. There is no contemplative atmosphere about the modern book. It has a bright superficial efficiency, like cheap woodwork grained and varnished. And they pretend to know everything, these smart, ill-paid young men who churn out elementary text-books. They have none of the humanity, the modesty, the hesitation, the large-minded doubts of a Newton.

I am not referring to modern research work because I am supposing you lack the training to read that at first hand. You want your science to interest and to exercise your speculative faculties in an agreeable manner. Then take my advice and read the old books.

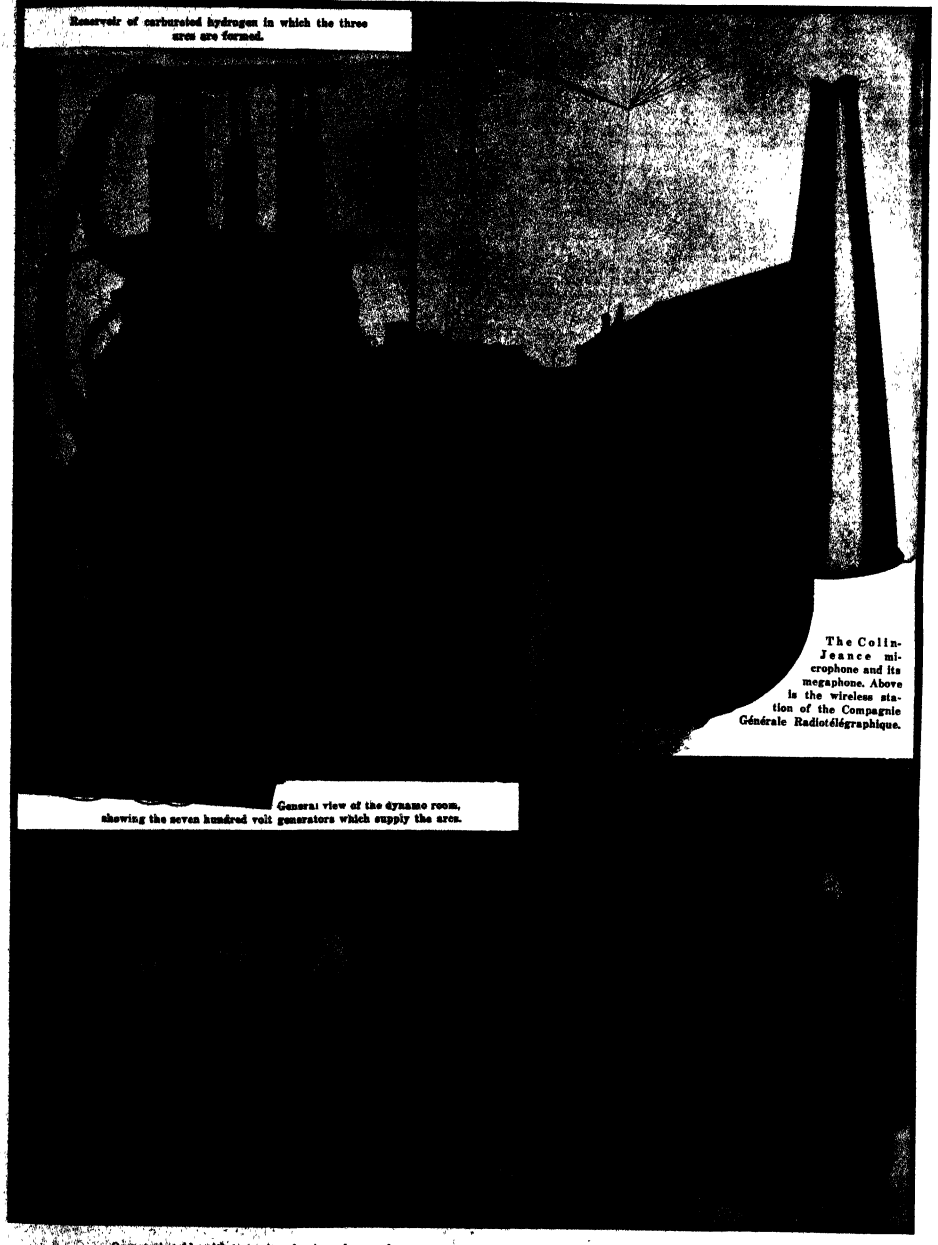
Analysis of Descent

PROF. WILLIAM BATESON, in his address on heredity before the British Society for the Advancement of Science, recalled the fact that the Mendelian theory was the first analytical study of the subject, and before this no orderly system of descent had been suspected. What he has to say about "blood," as the word is colloquially used, is particularly interesting.

"Misconception was especially brought in by describing descent in terms of 'blood.' The common speech uses expressions such as consanguinity, pure-blooded, half-blooded, and the like, which call up a misleading picture to the mind. Blood is in some respects a fluid, and thus it is supposed that this fluid can be both quantitatively and qualitatively diluted with other bloods, just as treacle can be diluted with water. Blood in primitive physiology being the peculiar vehicle of life, at once its essence and its corporeal shade, these ideas of dilution and compounding of characters in the commingling of bloods inevitably suggest that the ingredients of the mixture once combined are inseparable, that they can be brought together in any required amounts, and in short that in heredity we are concerned mainly with a quantitative problem. Many notions of genetic physiology are given by the Mendel-

expression 'seed.' If we speak of a man as 'of the best seed' we think at once of physical dilution, and we wonder how much of the royal fluid is likely to be in his veins; but if we say he is 'of the seed of Abraham' we feel something of the permanence and indestructibility of that germ which can be divided and scattered among all nations, but remains recognizable in type and characteristics after 4,000 years."

Novel Reinforcement for Automobile Tire.—Patent No. 1,107,672, to Clifford F. Kernen, of Cincinnati, Ohio, for an automobile tire combines reinforcing and non-skid features in a tire by embedding in the surface thereof a fabric of wire cables formed by interlooping strands from the adjacent circumferentially extending cables.



THE COLIN-JEANCE SYSTEM OF WIRELESS TELEPHONY

The Heavens in November

Transit of Mercury Across the Face of the Sun

By Henry Norris Russell, Ph.D.

THE present month is noteworthy for a decidedly unusual astronomical occurrence—the transit of Mercury across the Sun's disk, which happens on the morning of the 7th.

If the orbit of this innermost member of our system were in the same plane as that of the Earth, these transits would occur three times a year; but its plane is so much inclined (7 degrees) to that in which we move that at the great majority of conjunctions Mercury appears to pass north or south of the Sun, at a distance which is sometimes nearly 5 degrees, and almost always great enough to carry the planet clear of the Sun's disk

If, however, Mercury passes one of the nodes of the orbit (that is, one of the two opposite points at which, as seen from the Sun, its track would appear to pass in front of that of the Earth) within some eighteen hours of the time when it passes between the Earth and Sun, it will at this latter moment be actually in line between the other two bodies, and, as seen from the Earth, will appear to transit across the Sun's disk.

The Earth passes the points of its orbit which are in question upon the 8th of May and 10th of November, so that the transits always occur very near these dates (between May 5th and May 10th, or November 5th and November 14th) The May transits are only about half as numerous, in the long run, as those in November, because Mercury is much nearer the Earth in the first case than the second. In consequence, for the same real distance in miles above or below the line of sight from the Earth, it appears to be at a greater angle north or south of the ecliptic in May than in November, and has a better chance of missing the Sun's disk

Transits of Mercury recur in cycles of 46 years. During this interval, Mercury completes almost exactly 191 revolutions around the Sun, so that the two planets return to very nearly their positions at the beginning If then there is a transit on any given date, there will be another 46 years later, on the same or the following day of the month (unless indeed the first transit was very near to the edge of the Sun, in which case the repetition may fail) During each 46-year period there are at present four November and two May transits, as is illustrated by the following dates for the two centuries between 1800 and 2000 A.D.: November 9th, 1802; November 11th, 1815; November 5th, 1822, May 5th, 1832; November 7th, 1835, May 8th, 1845, November 10th, 1848; November 12th, 1861; November 5th, 1868; May 6th, 1878; November 7th, 1881, May 9th, 1891, November 10th, 1894, November 14th, 1907; November 8th, 1914, May 7th, 1924; November 8th, 1927; May 10th, 1937; November 12th, 1940; November 13th, 1953; November 6th, 1960; May 9th, 1970; November 9th, 1973; November 12th, 1986; November 14th, 1999.

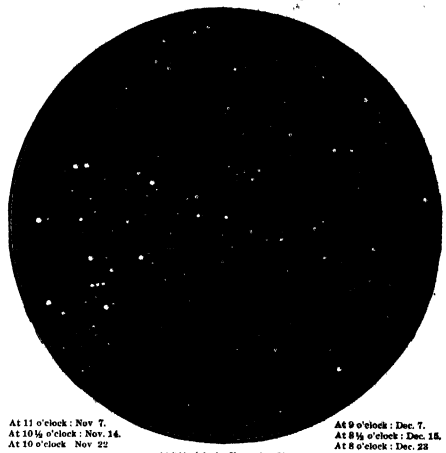
All these are repetitions in regular order, as shown in the above dates, except that one of the two series of May transits "runs out" in 1937, leaving but a single such transit in each cycle until a new series begins, which, from the run of the numbers in the table, will be on May 6th or 7th, A D 2003.

The transit of 1894 was completely visible in the United States, and that of 1907 partially so, as will be the case this year The next transits visible from this side of the world will be in 1953 and 1960

On the present occasion the transit begins before the Sun has risen over this continent, at 5 A M. by Eastern Standard time, and lasts a little more than four hours. It is half over before sunrise on the Atlantic coast, but the later phases, and especially the egress of Mercury from the Sun's disk, can be seen over a large part of the country. The extreme limit, along which the Sun will be rising as Mercury leaves his face, extends from Montana to Arizona, and the egress of the planet should be fairly well observable from points east of a line drawn from Texas to Minnesota.

The planet is too small to be seen without a telescope, being only 10 seconds in diameter, but a small instrument, if provided with a suitable shade-glass, will suffice to show it as a little black dot upon the Sun, perfectly round, and much blacker than any sun-spots which happen to be in sight (since the latter have some light of their own). The planet moves across the disk at the rate of five minutes of arc per hour, so that its shift will be apparent in a short time. It takes a little over two minutes to pass off the Sun's edge, the computed times of the first and last contacts between the borders of the planet and the Sun being 9 hours 7 minutes 17 seconds and 9 hours 9 minutes 31 seconds by Eastern Standard time for an observer who had the Sun right overhead. For stations in the United States the times will be a few seconds later. The point where the planet leaves the Sun will appear to be on the right-hand edge, a little above the middle, and the direction of the planet's apparent motion is upward and to the right.

The scientific interest of a transit of Mercury is not very great, being confined to the exact observation of the times of the apparent "contacts" of Mercury with the Sun's limb, which give valuable data for determining its exact position in its orbit. But the general interest of a phenomenon which cannot be observed again in this country for more than a generation should lead the amateur to observe it if he can.



NIGHT SKY: NOVEMBER AND DECEMBER

The Heavens.

As occasional queries arise about the explanation of the star-maps which appear every month on this page, it may be well to explain once more that they exhibit (as well as may be done on a flat sheet) the appearance of the sky as it would be seen by an observer lying on the ground and holding the map above him. The various points of the compass will in this case fall into their correct relative positions and the map will represent the sky. It may be more convenient simply to stand facing any given direction, and to turn the map about its center so that the corresponding point of the compass, as marked on its edge, is at the bottom. The lower part of the map will then show what stars may be seen in this region of the sky.

Proceeding in this way, we see at once that the southern sky is a dull region, occupied by the constellations Cetus and Eridanus. The southwest and west are little better, except for the great square of Pegasus, but the northwestern sky contains the fine groups of Cygnus and Lyra. In the north we see Draco and Ursa Minor, while Ursa Major is coming up in the northeast

The eastern and southeastern sky is by far the finest region in sight, containing Taurus and Auriga high up, Gemini and Orion below, and Canis Major and Canis Minor still lower, whose two dog-stars, Sirius and Procyon, have just risen.

The Planets.

Mercury is practically invisible in the first half of the month, except at the time of his transit, already referred to. During the latter part of it he may be seen as a morning star, best about the 22nd, when he is at his greatest elongation. On this date he is in Libra, and rises about 5 :15 A. M., so that he can easily be seen before the dawn gets too bright.

Venus is evening star until the 27th, when she passes through conjunction with the Sun, and becomes a morning star. She can be easily seen at the beginning of the month, in spite of her great southern declination of nearly 28 degrees, for she sets about an hour and a half after the Sun; but before November is half over she will be no longer accessible to observation with the naked eye.

This conjunction with the Sun is of unusual interest, for Venus comes apparently within 2 degrees of the Sun's center, and, when viewed telescopically, with proper devices for screening off the direct rays of the Sun, she should show very conspicuously the elongation of the horns of her crescent, due to twilight in her atmosphere.

Mars is still nominally an evening star, but is too near the Sun to be seen at all.

Jupiter is in quadrature with the Sun on the 6th, and counts thereafter as an evening star, as he crosses the meridian before 6 P. M. He is conspicuous in the southwest in the early evening.

Saturn is in the western part of Gemini and rises a little after 7 P. M. on the 15th, so that, though not yet in opposition, he is easily observable in the later part of the evening.

Uranus is in Capricornus, observable in the early evening, and Neptune in Cancer, where he may be seen telescopically in the small hours of the morning.

The Moon is full at 7 P. M. on the 2nd, in her last quarter at the same hour on the 10th, new at 11 A. M. on the 17th, and in her first quarter at 9 A. M. on the 24th. She is nearest us on the 17th, and farthest away on the 2nd and 29th. During the month she is in conjunction with Saturn on the 7th, Neptune on the 9th, Mercury on the 16th, Mars and Venus on the 18th, Uranus on the 22nd, and Jupiter on the 23rd.

Comets.

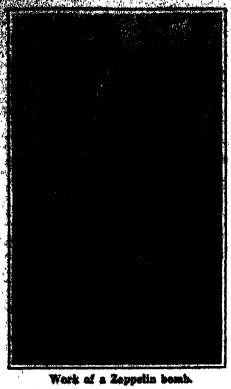
Delavan's comet is still well visible, though it has passed perihelion and is slowly diminishing in brightness. At the beginning of the month it is in Boötes, about 5 deg. northeast of Arcturus; and its motion is almost due southeast, at the rate of about 1 degree per day. On the 25th it passes close to ε Serpentis, and continues southeastward toward δ and ε Ophiuchi, which it will pass about December 10th.

All through the month it is almost due north of the Sun, so that it can be seen about equally well in the morning and evening, but only just after dark or before dawn, as the case may be. Its theoretical brightness at the beginning of December is about 40 per cent of that at maximum (in October). This would leave it but little below the third magnitude, so that it should be easily visible to the naked eye.

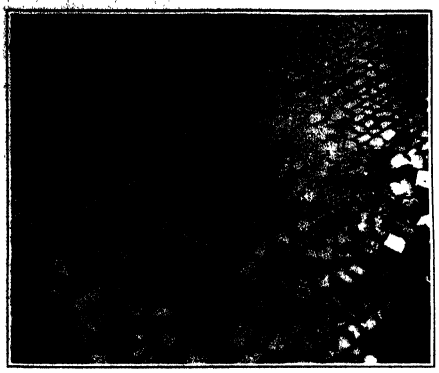
A second comet, also visible for some time to the naked eye, was discovered on September 18th by Mr. Leon Campbell of the Harvard station at Arequipa, Peru, and independently at the Cape of Good Hope. It was then in the southern circumpolar constellation Doradus, but moved rapidly northward, and became visible in the United States on September 25th, when it was again independently discovered by Prof. Haggerty of Las Cruces, New Mexico. It continued to move rapidly northward and westward, and to grow fainter.

The first rough elements of its orbit (computed as usual at the University of California) show that it passed perihelion some time ago on August 4th, at a distance of sixty-four million miles from the Sun. When first seen it was almost directly below the plane of the Earth's orbit, and only about thirty million miles away. The plane in which it moves is inclined nearly 78 degrees to that of the ecliptic, and its motion took it rapidly upward and outward, so that between September 13th and October 10th it described an arc of 90 degrees in the heavens and passed from the south pole of the ecliptic to the ecliptic itself. A diagram shows that it was closest to us about September 26th, when it

(Concluded on page 314)



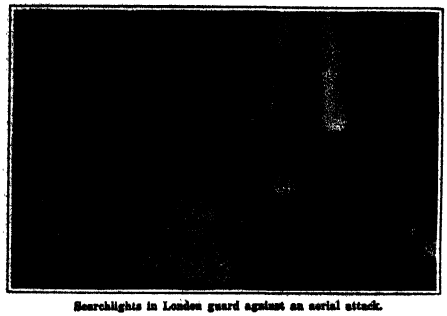
Work of a Zeppelin bomb.



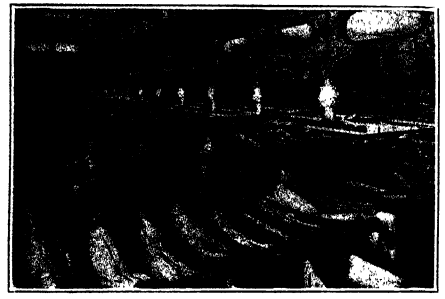
Hole in a street in Maastricht, produced by an aeroplane bomb.



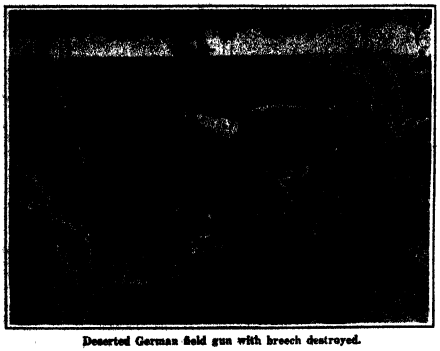
Pine tree nearly severed by a shell.



Searchlights in London guard against an aerial attack.



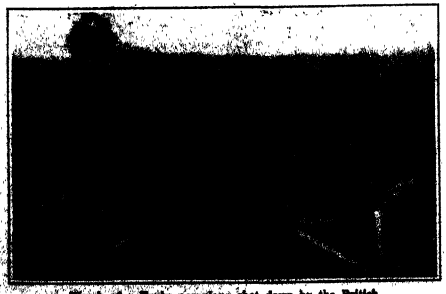
Sleeping quarters of the Royal Naval Volunteers in Crystal Palace.



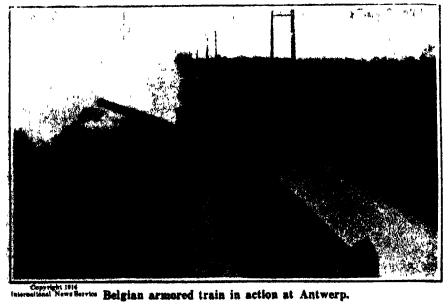
Deserted German field gun with breech destroyed.



Train destroyed by the blowing up of a bridge across the Ourcy.



Wreck of a Taube aeroplane shot down by the British.



Copyright 1914
International News Service

Belgian armored train in action at Antwerp.

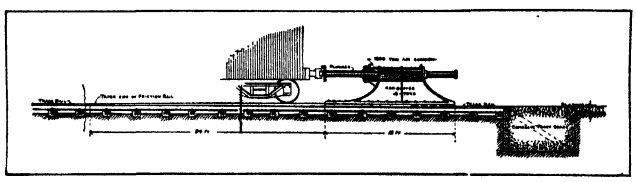
PICTURES FROM THE FRONT

Inventions New and Interesting

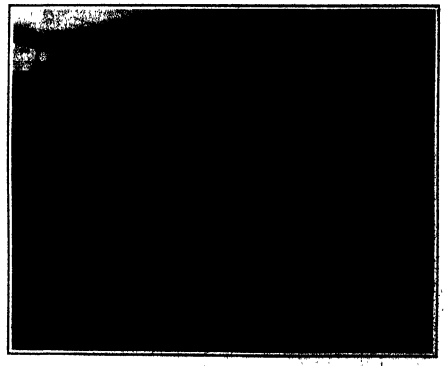
Simple Patent Law; Patent Office News; Notes on Trademarks

A Sliding Car Buffer

ONCE in a while, owing either to miscalculation upon the part of the engineer or failure of the air-brakes, a train enters a terminal station with such velocity that it cannot be stopped before reaching the end of the track. To bring the train to a halt when it is not under proper control, buffers of various designs have been used, but it is no simple matter to design a bumper that will stop a train without, on the one hand, doing harm to the train, or, on the other, being seriously damaged itself. Recently a car buffer has been invented which is not rigidly secured to the end of the rails, but is designed to slide upon the rail when the momentum of the train is greater than a certain predetermined amount. This buffer is formed with two long shoes or tapered friction rails that rest upon the track. The train rides up on these shoes, and if not stopped in time strikes a plunger projecting from a pneumatic cylinder. The air cushion back of the plunger serves to retard the motion of the train; but if it is unable to stop it, the whole buffer slides along on the rail, until the section between the buffer and the rail is sufficient to overcome the momentum of the train. In a recent test of this buffer, it was found that a 1,000-ton train traveling at three miles per hour was brought to a stop without sliding the buffer. At four miles per hour, the buffer slid 9 inches. At 8 miles per hour the displacement of the buffer was 3 feet, at 10 miles, 12 feet; and at 32 miles, 40 feet. Of course it is seldom that a buffer is called upon to stop a train traveling more than three or four miles per hour. After the rails have been displaced over 12 feet the rate of friction runs up extremely high and overcomes the momentum with greater relative ease. Because the buffer yields before the impact more or less in proportion to the speed of the train, no damage is done and the train is halted in the shortest distance compatible with safety.



Sketch of the sliding car buffer, showing the long tapered shoe or friction rail.



The pneumatic plunger of the buffer head.

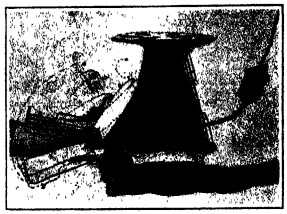
Misdirected Inventive Effort

FREQUENTLY we see in invention, as in other fields of human activity, failures resulting from misdirected effort. One phase of this is found where useful and ingenious improvements are made in arts in which the demand is so limited as to preclude adequate reward. Another is where the invention is made ahead of the demand. The attention of inventors is, therefore, invited to some almost unlimited fields. Take, for instance, the equipment of a military force. Today, if one could provide in any part of the clothing, furnishings, or accouterments of a soldier, an article of less weight and equal service or of better service with the same weight, or which possessed radical advantages of any character, an enormous market would be clamoring for a supply of the devices. Consider for a moment the demand for a man's sock that could be produced at the same cost and would give twice or any appreciable wear in excess of the ordinary ones on the market. If you are a chemist and can reduce the cost of sugar production or refining the smallest fraction of a cent per pound, or can produce a better or cheaper laundry soap, would you have to do more than demonstrate the proposition to reap a reward? A few weeks ago the SCIENTIFIC AMERICAN told of a large sum having been paid for a simple improvement in cameras. It was worth the large sum because the tremendous field for its application was already in existence. The inventive are, therefore, urged if not actively engaged in connection with a commodity of a large proportion, to seek a field in which the product of the inventive act will find a large demand in reasonable time.

It will be readily seen, from the instances furnished, that the range is sufficiently wide to enable any well-sustained effort to develop a successful inventor, one who should win a corresponding financial reward.

An Electric Toast Maker

SINCE the introduction of cooking by electricity many small pieces of apparatus have become popular on account of their convenience. One of the favorites is the toaster, which can be connected with an electric light fixture, and operated directly on the breakfast table. In most of the devices of this kind it has been necessary to handle the hot toast with the fingers, but a new device that has recently appeared does away with this objection.



An electric toast maker.

In the apparatus in question the heating elements, two in number, are set nearly vertical, with an inclination toward each other at the top, and the slices of bread are supported in the toasting position by wire grids on either side that are attached to pivoted rods across the base of the apparatus. When one side of the slice has been toasted it is not necessary to turn it with the hand to present the other side to the heating element, but the pivoted rod at the base is simply turned, dropping the supporting grid outward, as shown at *A* in the drawing. The inwardly turned fingers at the lower end of the grid coming in contact with the lower side of the slice of toast press it outward, and it slides down on the grid as shown at *C*, *C*', thus reversing the position of the piece of toast in relation to the heating element. On turning the grid up again, as shown at *D*, *D*', the untoasted side is presented to the action of the heating element. This entire operation requires only a few seconds, and as the hot slice does not have to be handled to reverse it, and as the operating knob is so placed that it does not become hot, the making of toast with the new apparatus becomes both convenient and agreeable.

Some Adjudicated Patents

AMONG the recent United States adjudicated patents may be noticed the following: The Wolhaupter patent, No. 538,809, for railway-tie plates, held void for lack of invention in view of the prior art in Railroad Supply Company v. Elyria Iron and Steel Company; the Marconi reissue patent, No. 11,913 (original No. 586,193), for an apparatus for wireless telegraphy, claim 3 held valid, but not infringed in Marconi Wireless Telegraph Company of America v. National Electric Signaling Company; the Lodge patent, No. 609,154, for improvements in apparatus for wireless telegraphy, held valid and infringed in Marconi Wireless Telegraph Company of America v. National Electric Signaling Company; the Wolhaupter patent, No. 691,332, for railway-tie plates, held void for lack of invention in view of the prior art, in Railway Supply Company v. Elyria Iron and Steel Company; the Wolhaupter patent, No. 721,644, for railway-tie plates, held void for lack of invention in view of the prior art in Railroad Supply Company v. Elyria Iron and Steel Company; the Jerrems patent, No. 745,625, for feeding mechanism for grass-twine machines, held valid, but not infringed in Steiger v. Waite Grass Carpet Company; the Marconi patent, No. 763,772, for apparatus for wireless telegraphy, held valid and infringed in Marconi Wireless Telegraph Company of America v. National Electric Signaling Company; the Nathan patent, No. 790,662, for a cover for automobile tires, held infringed in Allen Auto Specialty Company v. Niagara Auto Cover Company; the Jerrems patent, No. 824,871, for feeding mechanism for grass-twine machines, held valid, but not infringed in Steiger v. Waite Grass Carpet Company; the Layne patent, No. 821,653, for a rotary pump, held valid and infringed as to claims 20 and not infringed as to claims 4 and 13, in Van Ness v. Layne; the Hildreth patent, No. 832,384, for a candy-pulling machine, claim 4 construed literally and according to its natural import, is void as covering more than complainant actually invented in Hildreth v. Lauer & Suter Company.

Labels With Trade-mark Features

IN *ex parte* Wahrmann, Commissioner Ewing has held that where the matter presented is properly a label and is distinctively original, the statute does not prevent registration because the feature which gives the label originality is used or is capable of being used as a trade-mark, saying in the course of his decision, "the label in question is not a trade-mark and no trade-mark rights are acquired by registering it."

Shuttle "Kissing" in England.—United States Consul Ingram, of Bradford, England, refers to the threading of shuttles by the quick sucking motion known as "kissing the shuttle" and to the dangers resulting directly from the inhalation of lint and dust and the further danger of infection as shuttles are interchanged. It appears that disinfectants are employed and reference is made to the fact that one weavers' association in a report suggests that the real remedy is a self-threading shuttle, while another association expressed the opinion that a regulation making the use of self-threading shuttles compulsory could be made without any injury to the trade. While self-threading shuttles have been devised, it would seem that the field, in the event of compulsory regulation, is sufficiently large to encourage improvements.

RECENTLY PATENTED INVENTIONS

Selected inventions are open to all patentees. Those notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

SHIRT AND TROUSERS SUPPORT.—J. A. BEWIS, Ozark, Ark. This invention provides a support arranged to hold the shirt down and the trousers up without undue strain on the wearer's body, at the same time giving the desired comfort and allowing free movement of the arms, shoulders, and upper portions of the wearer's body.

Pertaining to Aviation.

AEROPLANE.—H. L. COAKLEY, 207 W. 14th St., Manhattan, N. Y., N. Y. By this invention Mr. Coakley is enabled to control by a single and simple expeditionary all of the movements of the aeroplane while in the air. The controlling devices, including a plurality of controlling planes, are arranged preferably at the rear, said planes being journaled on substantially horizontal axes extending transversely of the line of flight but at an angle to each other.

Electrical Devices.

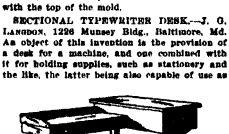
ELECTRIC BELL RINGER.—W. V. BARNES and G. C. COMBS, Address the former, Hillsboro, Wash. This invention is of that type which consists of a reciprocating striking element or hammer located in proximity to the bell or gong to impinge upon the same, the device being especially useful in connection with fire or other alarm boxes and other signal devices, where the bell sound is transmitted over great areas.

ELECTRIC HEATER.—H. A. GAMBLE, Greenville, Miss. This invention is an improvement in electric heaters for drop cosms, and has for its object the provision of an inexpensive and easily operated heater for maintaining a uniform temperature in the solution during its administration.

Of General Interest.

MOLD FOR PLASTIC MATERIALS.—C. DE MEMOURONNO, 108 Sixth Ave., Brooklyn, N. Y. This mold is particularly adapted for molding window-sills from cement or analogous plastic material. The adjustable ends having been slid along to the place required by the length of the sill to be molded, the box-like cavities on each side of the central board are filled with plastic material, and the same is scraped and smoothed at the top to form a surface flush with the top of the mold.

SECTIONAL TYPEWRITER DESK.—J. G. LANGDON, 1226 Munsey Bldg., Baltimore, Md. An object of this invention is the provision of a desk for a machine, and one combined with it for holding supplies, such as stationery and the like, the latter being also capable of use as



SECTIONAL TYPEWRITER DESK.

a writing desk for stenographic purposes. It provides a combined typewriter's and stenographer's desk of a novel form, which consists of detachable sections so that the stenographer's desk can be placed on one side or the other of the typewriter's desk.

CONTAINER.—C. J. ALLEN, 24 Hawthorne St., E. Orange, N. J. An object here is to provide a container which may be stamped from a single blank and folded so as to produce a tight receptacle capable of carrying liquid, and with securing or locking attachments for preventing the accidental unfolding or opening of the container.

METALLIC CONTAINER.—F. D. HAM, care of J. B. Prescott, Passaic, N. J. This invention relates to containers for containing shoe blacking, polishing preparations, paints, salves, etc., and provides a container having a tight-fitting cover and means for removing the cover from the body of the container and without the danger of the operator soiling the hands or spilling the contents of the container.

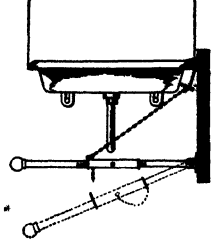
SHEET METAL PARTITION.—C. W. SAPPHAS, 1128 Princess Ave., Victoria, B. C., Canada. It is the design of this inventor to provide a partition to receive metal lathing and formed of sheet metal instead of more solid cast or rolled metal elements, whereby the partition may be much more cheaply produced.

MEANS FOR CLOSING AND LOCKING PORT HOLES AND THE LIKE.—W. V. GILMAN, Cambridge, England. This invention relates to means for closing and locking a porthole of a ship or an orifice in any other device of the kind comprising a carrier, which may serve as the closing piece, mounted on the ship's hull so as to turn about a hinge pin or equivalent in a plane axially and laterally clear of the port hole; a movable locking member, which may serve as the closing piece, co-acting with the carrier and the hull; and means for operating the carrier and locking member in the open position of the carrier.

BRUSH.—L. W. BULLARD, Cumberland, Md. This brush is especially adapted for use in applying oils and other liquid lotions to the skin and for applying liquid polishes to shoes and other leather goods, wherein a brush is provided having means for engaging a bottle to connect the brush to the bottle in such manner that the contents of the bottle may pass out ee to the operative face of the brush.

Household Utilities.

DRAINING TABLE FOR SINKS.—H. E. M. KINNEY, 137 24th St., East Prince Albert Sask., Canada. This folding draining table has the special features that the same fittings will suit any standard type or size of sink and that it requires no attachment to a wall or floor. It is immediately removable from one sink to



DRAINING TABLE FOR SINKS.

any other or to a laundry tub. The height is adjustable for any standard sink or tub, and the folding leg swivels in any direction to clear obstacles under the sink It is applicable to any sink, but is especially designed for cases where a door or passage makes a permanent fixture impossible or where space is important.

Pertaining to Vehicles.

VALVE FOR PNEUMATIC TIRES.—J. W. TAYLOR, 1440 Lyons Ave., Lansing, Mich. In the present invention the improvement has reference to a valve for pneumatic tires, the inventor's object being the provision of certain means by which to eliminate the danger of leakage and preserve and hold the flexible gaskets or washers utilized therein.

AUTOMOBILE SIGNAL.—J. A. ROSS, 115 W 46th St., Manhattan, N. Y., N. Y. Among the objects of this invention is the provision of a device for use especially on the rear ends of automobiles, under the control of the chauffeur or other occupant of the vehicle, but indicating to persons back of the automobile the intended movements of the automobile.

SLIDING DOOR.—F. S ADAMS and W. H. RICKARD, Pueblo, Colo. The improvement is in sliding doors, for automobiles and like vehicles, wherein the body of the vehicle is provided with a recess adjacent to each door opening, for receiving the door, and wherein the door is mounted to slide into and out of the recess, and wherein mechanism operates from the seat for opening and closing the door, and wherein normally active mechanism locks the door in closed position, the said mechanism being arranged in such manner that it may be released from the seat

AUTOMATIC AIR SUPPLY SYSTEM FOR AUTOMOBILES.—W. C. BARELS, Ridgewood, N. J. This invention provides an ever ready automatic air supply system for automobiles and the like, adapted to utilize the exhaust from the motor for the purpose of storing air under pressure to be utilized for the operation of the brakes, inflation of the tires or for other purposes.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

We wish to call attention to the fact that we are in a position to offer competent services in every branch of patent or trade-mark work. Our staff is composed of mechanical, electrical and chemical experts, thoroughly trained to prepare and prosecute all patent applications, irrespective of the complex nature of the subject matter involved, or of the specialised, technical, or scientific knowledge required therefor.

We also have associates throughout the world, who assist in the prosecution of patent and trade-mark applications filed in all countries foreign to the United States.

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Saving $10,000 a Day in the Navy

(Concluded from page 349.)

Navy Department lopped off $1,107,860 from the prices which prevailed during the previous year! Bids for 3,500 14-inch armor-piercing shells, 1,500 12-inch armor-piercing shells, and 30,000 4-inch and 5-inch common shells for the use of the Navy were awarded early in the year with a decrease of $889,825 in the bids for the quantities specified or of $1,107,860 if advantage were taken of the right to increase the orders 25 per cent over the original contract This right will be exercised.

The greatest cut in prices on any one item was made by the Bethlehem Steel Company, which secured contracts for 4-inch common shells last year at $9.50 each, and this year offered to take the entire lot of the same shells at $5.46 apiece, or a little more than one half of last year's price. The Crucible Steel Company cut their bids on 14-inch armor-piercing projectiles from $500 in 1913 to $300 in 1914, while the Bethlehem Steel Company's bid dropped from $500 to $320.

The $150,000 or more which has been saved to the Navy within the past year through the reclamation of copper is only a single illustration of the unrecognized wealth which long lay within the grasp of the Government only to be allowed to slip through the fingers of the administrators.

The scrap metal which accumulates so rapidly at every navy yard and gun factory contains a considerable percentage of copper. Formerly this metal was either sold outright for a fraction of its value or was turned over to the "outside" refineries, which were supposed to extract the copper and return it to the Government. About 20 per cent of the metal was returned as copper under this method Within the past year, however, it was decided that it would be more economical for the Government to extract its own copper and thus insure full value Experiments with the scrap metal showed that the return of copper, when the extracting was done under Government supervision, amounted to about 60 per cent of the gross weight! Under present conditions no copper scrap is turned over to outside firms, but it is all treated by the Government. The returns have been so great that the Navy Department has not had to buy any copper during the past year. As the amount of copper annually used by the Navy was well over 1,000,000 pounds, at 15 cents a pound, the saving by the present method is considerably in excess of the $150,000 listed in the summary of the year's savings.

The economy in other scrap metal —estimated by Rear Admiral Cowie, Paymaster General of the Navy, at about $300,000— has been effected mainly through expert supervision of the disposal of the scrap and the efforts of the Department to place the metal on the best possible commercial basis.

The $500,000 saving credited to "food, clothing, and other supplies" was effected by watching the markets closely and buying in large quantities when the prices were lowest. For example, $20,000 was saved on cloth in a single contract and $5,000 on one purchase of sugar. Scarcely a week passes without a considerable saving being effected on some item for which contracts are opened every Tuesday. The paymasters in charge of this work are authority for the statement that the saving within the past fiscal year amounted to fully half a million dollars, and it is probable that as much more will be pared off during the coming year.

Through the medium of the same careful watching of all expenditures, no matter how small, the Department has been enabled to save not less than $143,423 on the requisitions which have been made by various ships and navy yards throughout the year. This is clear profit, because quality was not sacrificed in a single case. The economy was effected by buying in large quantities, by eliminating unnecessary articles from the requisitions and by strictly enforced competition in the submission of bids.

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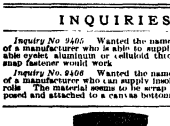
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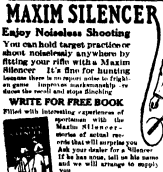
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the Atlantic Fleet during its European cruise last fall saved the Government about $75,000. It had formerly been the custom of the Department to purchase coal at the various ports where the fleet called. This naturally resulted in raising the price of coal in anticipation of the arrival of the American ships, and the experiment of having the colliers accompany the fleet was so successful that the old method will not be reverted to.

The other two savings noted in the summary—the transportation of men and materials and the construction of the channel at Mare Island, Cal.—were the direct result of the new policy of substituting real competition for the spurious kind.

In future the former brand will be the only one recognised by Uncle Sam, and the Navy Department will try to outdo its own record of saving $10,000 a day for an entire year.

The Heavens in November

(*Concluded from page 354.*)

was only about twenty million miles away.

By the beginning of November it will be about one hundred million miles from us and one hundred and sixty million from the Sun, and less than one fiftieth as bright as when nearest us, so that it will be visible only with telescopic aid.

The preliminary ephemeris, which alone is at hand as this is written, run out on October 14th, but a rough extension shows that on November 1st the comet will be near ε Pegasi and observable almost all night long.

Encke's comet, whose period of three years and three tenths is the shortest known, is once more under observation, having been found by Prof. Barnard on September 17th. It was then in Perseus, and high in the heavens for most of the night; but as it was of the fourteenth magnitude, it is not likely to be observed with any but the greatest telescopes.

Princeton University Observatory.

Tempering Bronze

ALTHOUGH hardening bronze has long been considered as one of the celebrated lost arts, still it is certain that it may be hardened by heat treatment. Guillet's experiments in this direction show that some of the bronzes, namely, those containing 15 to 20 per cent of tin, may be made malleable when heated, although they are brittle when cold. Making tests of copper alloys with various percentages of tin, from 5 to 21, and with temperatures ranging between 300 deg. and 800 deg. Cent., he found as follows:

1. Alloys with more than 92 per cent copper are made more resistant to breakage by tempering at from 400 to 600 deg. Cent.; the ductility increasing with the temperature employed.

2. Alloys with less than 92 per cent of copper are increased in resistance to breakage and in ductility in still greater proportion by heating to temperatures above 500 deg. Cent. The greatest tensile strength was attained, with all specimens, by treating them at about 600 deg. Cent. The maximum extension in length seemed however, to depend on the composition of the alloy. With bronze having 81 copper to 19 tin, it occurred at 800 degrees; with 79 copper and 21 tin at only 600 deg. Cent. The difference in tensile strength between untempered castings and those tempered at the proper degree of heat is greater in inverse proportion to the percentage of copper. In general, it may be said that tempering bronze at heats between 600 deg. and 800 deg. Cent. has its principal effect in increasing the tensile strength.

As regards the effect of tempering on the co-efficient of friction, this will be taken up in later experiments.

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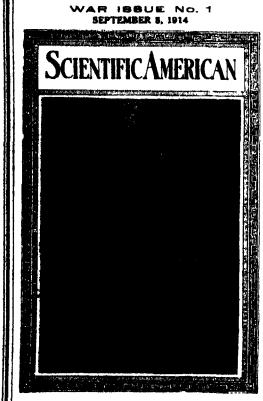
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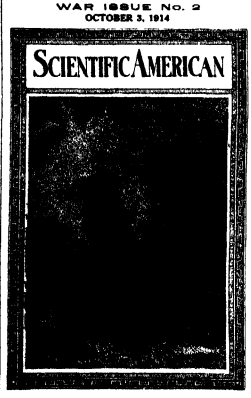
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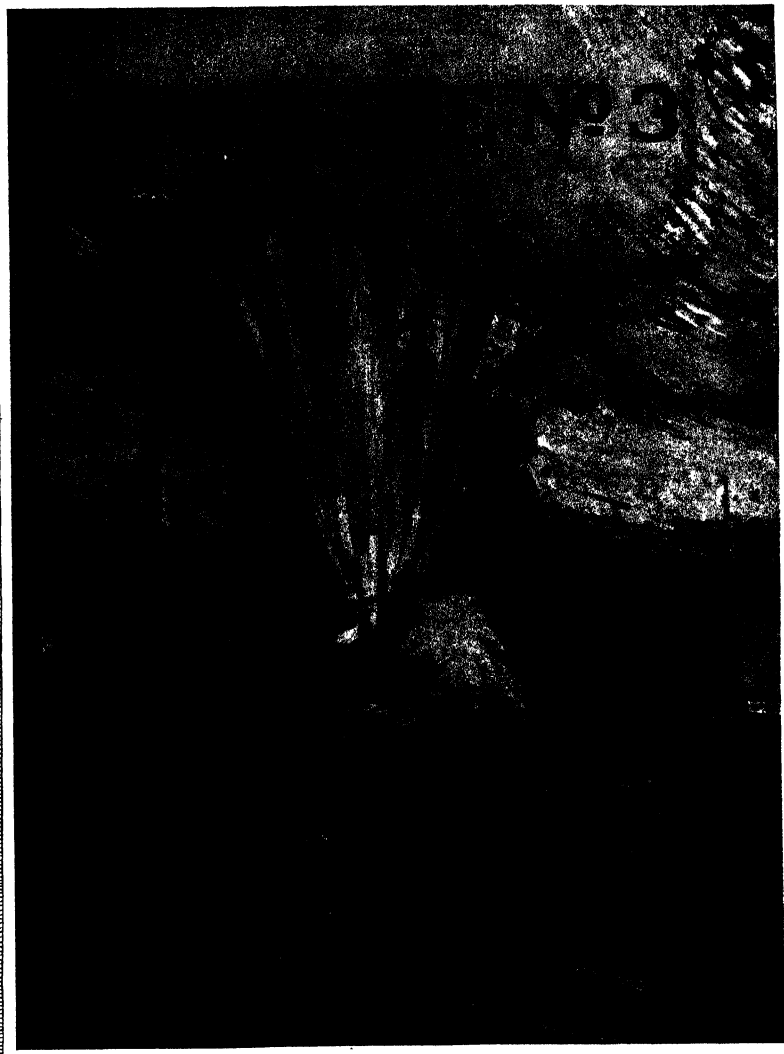
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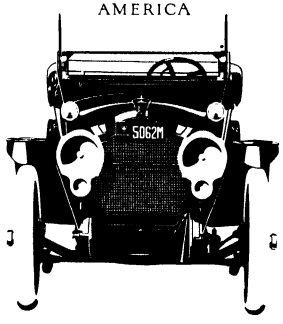
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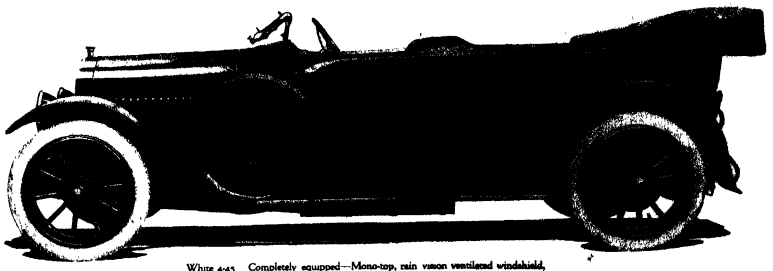
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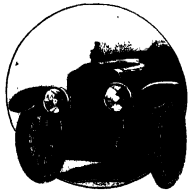


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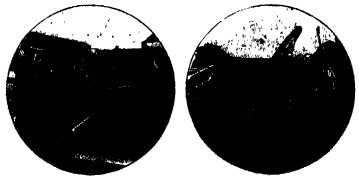
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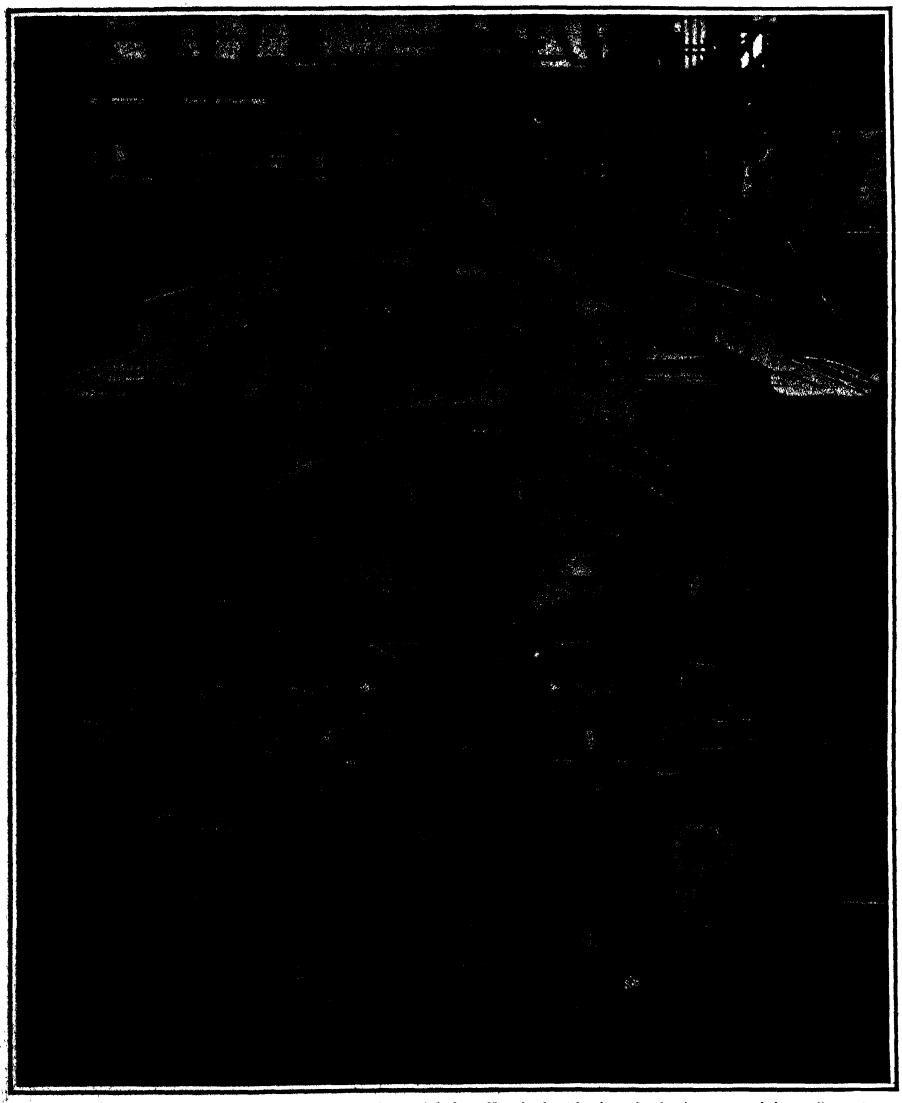
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SEVENTIETH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXI. NUMBER 19.] NEW YORK, NOVEMBER 7, 1914 [25 CENTS A COPY $3.00 A YEAR



View of the interior of a German submarine before the rear section was bolted on. Note the thrust bearings, the electric motors, and the gasoline engines.

MODERN SUBMARINE WARFARE.—[See page 376.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest If the photographs are *sharp*, the articles *short*, and the facts *authentic* the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Mechanical Fatigue in a Machine-made War

THIS is very largely a machine-made war, and it would be a curious and not altogether illogical *denouement* of the great struggle if its end should be hastened through the fatigue of the machine rather than the exhaustion of the man.

This war is being fought with the gun and the motor-car, and so strenuous and uninterrupted has been the struggle that these have been put to a test of endurance the like of which has never been witnessed in the history of artillery or the briefer but very strenuous history of the gasoline car.

The life of the gun, so far as its absolute destruction by bursting is concerned, is practically unlimited; but not so its accuracy-life. Every time a gun is fired some of the interior surface of its bore and delicate rifling is wiped away, and a certain degree of its accuracy is lost. This is true of the shoulder rifle, with its bore so small that it would not much more than admit a lead-pencil, no less than of the great 16-inch siege gun of the Germans. Fortunately for the infantryman, the wearing out of the bore decreases rapidly with a decrease in the size of the bore. Erosion, as it is called by the artillerymen, is greatest in the large guns and least in the 0.30 rifle. The big guns which form the main batteries of our warships and are emplaced in our coast fortifications can fire from 150 to 250 rounds (dependent upon the pressure and heat in the powder chamber) before they begin to lose their accuracy.

No such loss of ballistic qualities is occurring in the German howitzers and siege pieces, however, and this for the reason that the velocity, and therefore the pressure and the heat of explosion in the powder chamber are very much lower in the howitzer than in the direct-fire high-velocity gun. Nevertheless, their heavy siege pieces, like everything else in the German army, are being worked at top pressure; and already the German artillerymen must be beginning to find that there is a discrepancy between the estimated and the actual point of fall of the high explosive siege-gun shells.

As regards the 3-inch field pieces, although, according to the law, the erosion of the bore is less as the diameter of the bore gets smaller, we must remember that these field pieces have been worked, most of them to their full capacity, for some three months of the hardest and most continuous fighting the world has ever seen A large percentage of the 3-inch field pieces, both of the Germans and of the Allies, must show serious deterioration. Hence, if the efficiency of the artillery big and little is to be maintained, there must be a continual process of renewal going on The worn-out guns must be taken from the fighting line, shipped back to the arsenals and gun factories, and either rebored and relined, or else absolutely new weapons must be sent out in their place. But how is this to be done over roads that are already congested with the enormous supplies of food and ammunition and the heavily loaded trains of reserves and wounded?

Even more severe must be the depreciation which is going on in the motor-car transport service The motor-car is a highly developed machine, which calls for careful upkeep to maintain it in full efficiency. In ordinary commercial service the motor car and the automobile receive, as a rule, considerable care and watchful maintenance. In the present war, however, the treatment of these vehicles, must, in the nature of things, be absolutely brutal, and the depreciation must be very rapid. Where are the repair shops that can keep pace with this depreciation, and how shall the necessarily enormous wastage of the war be made good?

It may well be that the fatigue of the machine rather than the weariness of the man will hasten the close of the present war.

Feeding the German People

AS time passes without any signs of abatement of the military operations and the isolation of Germany is becoming constantly more complete, it is very apparent that the question of supplies for the German nation must soon become most pressing, not only as regards military material, but especially in the matter of food, for food is as essential to success as guns.

This question has been frequently discussed, but mostly in the way of considering recent claims put forth by Germany, or the public statements of Count von Moltke, made early in the year, that Germany could produce within her own borders all the foodstuffs necessary for the maintenance of her people for an indefinite period.

The fact, however, has apparently been overlooked that in his estimate Count von Moltke reckoned that it would never be possible to close the German ports against importations; and he furthermore was undoubtedly misled by the statistics which showed that importations of food grains had decreased during the past few years, and moreover that Germany has even been exporting considerable quantities of rye of late.

It is very likely that these same views were also held by the German government, and if that is the case a brief review of some further facts and statistics, also from German sources, will show what a most serious error was made in estimating food supplies, as has also been made in other vital matters.

These facts are furnished by Dr. Carl Ballod, a professor of the University of Berlin, and an authority on the subject he discusses in an article that appeared in the *Preussische Jahrbücher*, the same publication that contained the statement of von Moltke. As an offset to the grain exported, which can now be added to the home supplies, Dr. Ballod calls attention to the fact that in 1912, according to the latest statistics available, Germany imported ten million tons of grain and fodder, and in addition to this the equivalent of five million tons of food grains in the form of cattle, meat, tallow, herring, eggs, butter, and cheese, valued at nine hundred million marks ($225,000,000).

Accepting the German harvest statistics of twenty-six million tons net of grain of all kinds as correct, it is apparent that in 1912 Germany imported at least one third of her necessary food grains. But Dr. Ballod goes further, and, after examining the methods employed in collecting the harvest statistics, he concludes that the estimates are at least fifteen per cent too high, and that the amount of food grain produced in 1912 amounted actually to only about twenty-one million net tons; so the home resources are in this direction very much less than what has been relied on.

With the cutting off of the sixty per cent of her fodder supplies, which was imported, it would be impossible to sustain all her domestic animals, and it would become necessary to slaughter large numbers of cattle; and although this would add considerably to the temporary supply of meat, it would by no means make up for the loss of the amount ordinarily imported.

What proportion of the imported food grains were derived from the United States, Canada and South America is not stated; but the amount must have been very considerable. Dr. Ballod makes a survey of conditions in the various neighboring countries from which supplies might be secured, notwithstanding a blockade of Germany's ports, cutting off transatlantic importations, if such material were available; and his conclusion is that no European nation produces more in the way of foods than it requires for home consumption, and in most cases it is necessary to add to their resources by importation. In ordinary years Austro-Hungary has absolutely no surplus, and at the present time requires all it has, and more. Roumania is a possibility; but her friendship is doubtful. Even if the grain ships from across the sea could reach the open ports of Norway, the single track railways, with high rugged mountains to cross to reach the Swedish ports in communication with Germany, could hardly be relied on to transport the necessary quantities.

Another feature of the problem that arises is that in making her estimates of home production, Germany never supposed it would be necessary to call out practically her entire male population; and as this has apparently been done, it will certainly result in an immense diminution of her resources, although it is probable that a large portion of her harvests had been gathered before her fields were denuded of workers.

A point that Dr. Ballod discussed at length was the establishment of great depots in some part of the country, where food might be collected and stored in anticipation of war conditions; but its advocates convey no intimation that this has been done, nor has any question of the kind come from other sources. While undoubtedly a large amount of specially prepared food for the army was provided for, the question that threatens to confront Germany in the near future is that of feeding her entire population, and, judging the prospects wholly from these home estimates, the outlook is far from rosy.

An article appearing in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT deals with this question of Germany's food supplies, and gives Dr. Ballod's figures and arguments quite fully.

Immigration in 1914

IN the course of the epochal weeks which have just passed, the closeness of our relationship to the rest of the globe has been brought home to us in a most forcible manner through many channels. No longer, we now realize, do we stand apart, splendidly isolated. Steam and electricity have brought all peoples to our threshold, indeed, far within our house. Nations cannot now live to themselves alone. The forces that play upon the life of one, are felt in the brotherhood of nations. This has been markedly illustrated in the story of the migrations of the year, not only of those ending and beginning in the United States, but those flowing between other countries.

The most evident fact about the flow of the current of American immigration is that since the war there has practically been none. Nowhere in the written record of our immigration is there anything to indicate that the stream has ever before been stayed so abruptly in its course, or reduced to such a small volume in proportion to its ordinary flow. The sudden introduction of this fresh factor among the influences regulating the current offers ample opportunities for the exercise of the abilities of the would-be prophet. This is the first time the expert has been permitted to study the relationship of immigration and a great war which affects the sources. Since the means of easy transportation and intercommunication became available for practically all classes of society there has been no war comparable with the present one to serve as a guide in formulating a prognostication. The problem is complicated by factors previously non-existent. It is quite generally assumed, however, that conditions in Europe following the immense and inconceivable destruction of wealth, will stimulate immigration when the war is concluded. The loosening of provincial ties resulting from campaigning will tend, doubtless, to make it easier to forsake the homeland, and the widowed and fatherless among the womenkind may find it to their advantage to emigrate to a country which needs servants.

The Government's custom of ending and beginning its year in the middle of the calendar year eliminates from the record of the one recently closed any evidences of the effect of the war upon immigration. The record, however, does show very clearly the growing sensitiveness of human world currents to local conditions. This was the distinguishing characteristic, not only here, but in the records of other lands. Had the flow continued through the second six months at the same rate that it did through the first, a new record would have been established, for more than 800,000 immigrant and non-immigrant aliens knocked at our gates between July 1st and December 31st, 1913. This, ordinarily, would have meant admissions exceeding 1,600,000 for the twelve months, the greatest known migration in a single year. The flow was checked, however, in February, and the total number of aliens admitted was only 1,403,081, a number slightly less than that of last year.

The reason for the abnormal volume in the first half of the year, was not, as is usually the case, particularly favorable economic conditions here, but extraordinarily bad at home, coupled, in Italy, with a desire to get into the country before a literary test could be adopted. Unfavorable conditions in Austrian and Russian Poland stimulated the flow of Slavs from that region, the Balkan war being responsible in a measure for the poor crops in Galicia. Floods supplemented the evils occasioned by the calling of the laborers to the colors. The Jewish boycott in Russian Poland tended to augment immigration from that region. The Stolypin act of 1910, which freed the peasants from the land, and the close of the Balkan war are responsible for the relatively large immigration of Russians and the record movement of Slavs from the Balkans.

The Argentine immigration was smaller last year than usual, owing to poor crops and the consequent reduced demand for labor. Upward of 300,000 Italian "birds-of-passage" supply Argentina's annual needs, the ebb and flow of this great human tide being facilitated by competition between the lines which constitute a one-way rate of $7.50. Economic conditions in Canada before the war broke out were so bad that the outward movement of immigrants was greater than the incoming.

Science

Spitsbergen, the political status of which is still unsettled, will hereafter be linked more closely than ever to Norway, in virtue of a subsidy recently granted by the government of the latter country to a Norwegian steamship company, which has undertaken to make at least six trips to Spitsbergen each year, beginning next spring. On the first three journeys of the year the steamship will endeavor to communicate with the various fishing vessels in that part of the Arctic. It will be equipped with wireless, and will carry passengers, freight, and mail. During the last summer extensive surveys were carried out in Spitsbergen by a Scottish expedition under Dr. W. S. Bruce. This work was cut short by the war, and the party returned to Scotland September 18th.

The Demarcation of the Alaska-Canada Boundary from the St. Elias Range straight north along the 141st meridian to the Arctic Ocean has been in progress since 1907, and is reported to have been completed during the past summer. This undertaking was notable for several reasons. No other modern boundary demarcation has extended into such high latitudes, and few boundaries of equal length anywhere in the world are so straight; the line follows the meridian without the slightest deviation, regardless of mountains, swamps, and forests. Wherever the boundary passes through timber and brush a 20-foot clearing has been made. Monuments have been set up along the entire line, at points visible from each other; generally at distances of three or four miles. At important points these monuments are 5-foot shafts of aluminium bronze, weighing 300 pounds, set in 2,000 pounds of concrete. The boundary is 600 miles long, and is marked by about 200 monuments.

The Influence of Atmospheric Conditions on Animal Metabolism.—An interesting paper presented by W. Thomson to the Manchester Literary and Philosophical Society gives the results of a series of observations on the amount of carbon dioxide in the air exhaled from the lungs of human beings and animals in relation to the current barometric pressure, humidity, and temperature. These observations showed quite uniformly that a rise in barometric pressure, humidity, or temperature is accompanied by a decrease in the amount of carbon dioxide exhaled, while a fall in any of these produces an increase in carbon dioxide. These relations to the ordinary fluctuations of the weather were confirmed by such experimental observations as that the percentage of carbon dioxide in the exhaled air was greater when the inhaled air had been previously dried with sulphuric acid; that the percentage was greater at high elevations than in valleys; and that it was greater when the body was surrounded by cold air than when surrounded by warm air.

A School of Forestry in the Philippines, which was established in 1910 as part of the College of Agriculture, University of the Philippines, has made excellent progress, and has been well attended. The college and school are situated near Los Baños, at the base of Mount Maquiling, about forty-two miles from Manila. The mountain, which is almost wholly forested, constitutes a forest reserve of about 15,000 acres, furnishing the students ample practice in the various branches of forestry. Besides general work in the reserve, each class is expected to improve one hectare (two and a half acres), making a modest forest on a small scale to remain as a monument to the class. The course covers two years. Students are selected from all parts of the Islands. On graduation they are sent to provinces other than their own, and after four years' service they are to return to their home provinces. One of the difficult features of forestry in the Philippines is the great number of tree species, all of which the forester should be able to recognize. The Philippine Herbarium contains specimens of more than 2,500 species of trees.

Tibet continues to hold its special fascination for explorers, and it is therefore interesting to learn from the experiences of Captains Bailey and Morshead, who recently cleared up the long-standing mystery concerning the connection between the Tsangpo and Brahmaputra rivers, that a noticeable change has come about in the attitude of the Tibetans toward foreigners. These explorers encountered no signs of hostility or distrust, except when they were mistaken for Chinese, who appear to be held in great dread. No objections were made to the surveying operations, and Capt. Morshead asserts that "it is now possible to traverse the country from end to end, openly, with plane-table and theodolite, and without even the formality of a pass from Lhasa." Apparently the Tibetans have learned that the British are their best protectors from Chinese aggression. Apropos of the Tsangpo-Brahmaputra, the current number of **Petermann's *Mitteilungen*** announces that the Austrian explorer, A. K. Gebauer, who is now traveling north from Burma along the Chinese-Tibetan border, intends ultimately to strike west to the Tsangpo and follow this river through the passes of the Himalaya.

Automobile

An Aid for Stalled Automobiles.—C. L. Parish and F. C. Ferrell of Harrisburg, Ill., in a patent, No. 1,108,221, supply a traction device for a stalled automobile in which a toothed rack-bar is suitably anchored and a toothed pinion meshing with such bar is applicable to the hub and spokes of one of the drive wheels so the operation of the engine can push the automobile out of the rut.

Gasoline as a Factor in War.—In the present European war gasoline has come to be regarded so much a necessity that it has been referred to in some quarters as a war of gasoline. Should the supply give out and no substitute develop, it may play a large part in the termination of hostilities. Possibly the demand for a motor explosive may cause the European chemists to develop a substitute for gasoline or a means to supplement a limited gasoline supply.

Motor Transports of the Russians.—A correspondent of a London paper, who was present at some of the military operations in East Prussia, tells of encountering a train of military motor transports on the road near the fighting line, each truck loaded with about thirty men, packed like sardines. "They were traveling like no motor wagon that I ever saw—certainly at not less than forty miles per hour. The procession seemed endless. I didn't count them, but there were not less than a hundred, and perhaps a good many more. That was Gen. Rennenkampf reinforcing his threatened flank."

Exterminating Prairie Dogs.—A correspondent in South Dakota writes that in his part of the country the automobile has been found a great success as a prairie dog exterminator. A piece of hose slipped onto the exhaust conducts the gases into the dog hole for a few minutes, when the hole is covered with earth. That is enough for the dog. Of course some automobiles are more efficient in this sort of work than others, and the machine with an exhaust that will kill a dog might find favor in some other parts of the country as well as on the prairies; but manufacturers are not likely to lay much stress on this feature of their machines.

Few German Military Vehicles.—In view of the present France-German imbroglio, it is interesting to note that in March of the present year Germany had but 1,225 motor trucks of a type suitable for military use. Of these, 825 actually had passed the military requirements and their owners had received subventions. The subvention amounts to 3,000 marks or about $750 for an army wagon with one or more trailers, and 1,800 marks or about $450 for an ordinary truck. This amount may be considered the purchase price, although for the succeeding four years the owner receives as a premium 1,200 marks, or $300 annually for an army train and about $200 annually for an ordinary truck. These 825 vehicles were supplied by 15 makers.

Rear Gasoline Tanks and Tail Lamps.—The placing of the gasoline tank at the rear of the chassis has become such common practice that the tail lamp becomes of greater importance. It is well that electric lighting has made such strides, for in the modern car there is little danger from a leaky tank in this position. But what of the older cars that were built with rear tanks, and which still have *oil tail lamps*? With them the danger is real. Obviously, a person with ever a modicum of common sense will put the light out when *his fuel supply is replenished*. But no one can be expected to keep the close watch for leaks that the juxtaposition of an oil lamp and gasoline tank requires. Perhaps some sort of a lamp built on the type of a miner's lamp might better preserve the car and its contents, but still even a lamp of this kind can be broken, and there is always the danger of rear end collisions.

Fuel for Automobile Motors.—A number of efforts have been made abroad to stimulate the development of internal combustion motors suited to the use of alcohol, and its introduction as a fuel for automobiles, and various experiments have been made and competitions held with this object. Recently a series of tests was conducted on the Brooklands track in England by the Royal Automobile Club with a 15-20 horse-power car, using gasoline, benzole, and alcohol, and it is interesting to note that an improved modern engine can be operated successfully with either of these fuels, the only change necessary being a slight adjustment of the carbureter jet. With gasoline an average of 36.8 miles per gallon was made; with benzole, 40 miles; and with alcohol, 23.2 miles. With a half and half mixture of the two latter fuels the consumption was a gallon per 32.4 miles. As is well known, it would be necessary to increase considerably the compression over what is desirable with gasoline, to obtain the best efficiency from alcohol; and to secure the same power results the size of the engine would have to be increased. Still this test will emphasize the fact that any good modern engine can readily be adapted to work on alcohol, although the present price, owing to Government duties, prohibits its regular use.

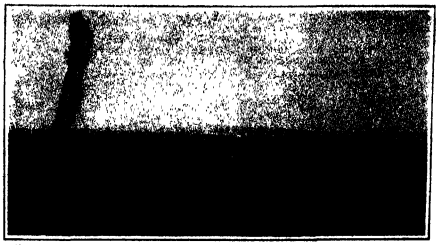


Photo by Bain

Belgian artillery in maneuvers.

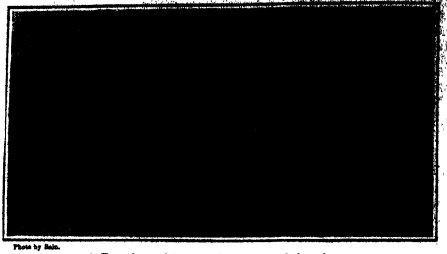


Photo by Bain.

A French machine gun battery carried on horses.

The Efficiency of European Armies

The War a Struggle Between Highly Trained Men

By H. Bannerman-Phillips

THE efficiency of the French army may well claim priority for consideration in any discussion of the comparative value of the European troops now in the field and at close grips with one another. In regard to the human material, the Frenchman, as is well known from the times of the armies of the first republic and of Napoleon, makes a good soldier. His dash, spirit, and marching power are valuable qualities. His vivid imagination and superb initiative—the latter an important asset when exercised within reasonable limits—are calculated to enable him to cope successfully with the exigencies of modern warfare. The army of the French Republic of 1914 is very different from that of the Empire in 1870. This time the superiority of its arrangements in peace time has been shown by the smoothness with which mobilization has taken place. In 1870 the leadership was hampered by the defective personality of Napoleon III and the supposed exigencies of a policy based on dynastic considerations; now we may assume, from the accounts of the fighting which have reached us thus far and the known views of the leaders, that the army is imbued with dauntless energy, but cherishes no illusions as to the magnitude of the task before it, and is well led. Thanks to the moral and material assistance afforded by Belgian heroism and self-sacrifice, and to British support, it has been enabled to make what are presumably the best possible dispositions for meeting the long-threatened attack over ground which is known and under conditions which its leaders have had under earnest consideration for years.

The French General Staff has based its study of war upon the campaigns of Napoleon and the Franco-German war of 1870-71, and the Army Regulations have been revised from time to time in the light of modern improvements, the advent of reconnaissance from mobile aircraft, and the conduct of recent campaigns. The French leaders realize, no doubt, that in the presence of an enemy which, like the Germans in the present instance, has taken the initiative in operations, it is possible only by a vigorous counter-offensive to give a favorable turn to the conflict. They realize that only the offensive leads to positive results and are prepared to take it with "*élan*" and fury, but they have also apparently that invaluable quality of iron self-control which will prevent them from playing into the enemy's hands by too impetuous action against superior numbers. They will endeavor by strategical action to create situations favorable to themselves before risking the expenditure of all this force on decisive action, rather than accept situations created by the disposition of the enemy. If they retire, it will be a case of "*reculer pour mieux sauter*"; their retirement will have nothing of timidity about it. They will keep reserves in hand to protect their flanks and to form points of support, but they will use them in the final resort to reinforce the fighting-lines and turn imminent disaster into assured success rather than to cover a retreat.

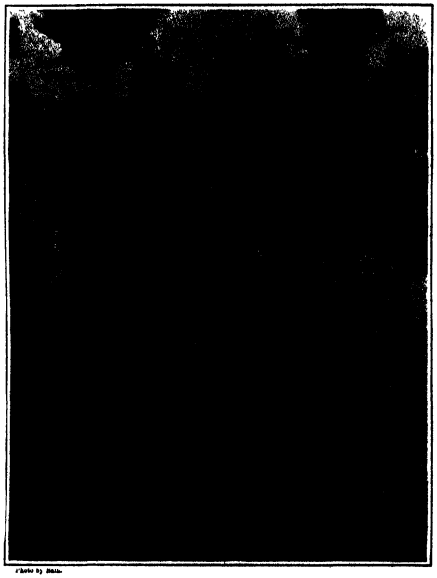


Photo by Bain.

Gen. Joffre, in supreme command of the French forces.

In regard to numbers and weapons, the strength of the French army is about 4,000,000 men, as far as can be ascertained, divided into twenty-one army corps, for service in Europe, while one army corps is absorbed for Algeria. The rifle used is the Lebel of 31 caliber, somewhat out of date, but which seems to be giving a good account of itself, nevertheless.

The French army is somewhat deficient

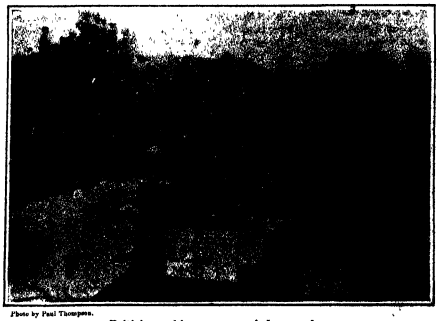
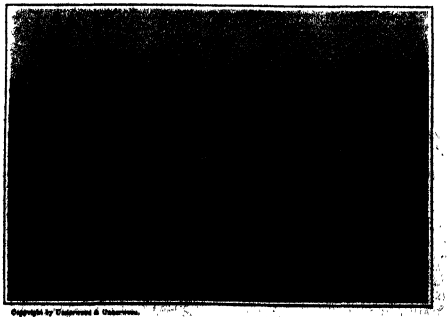


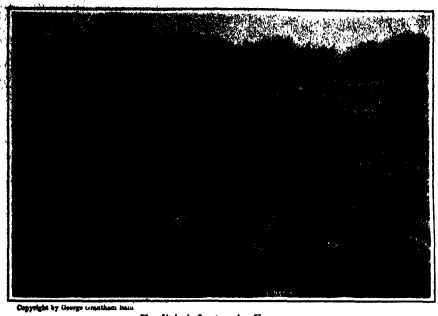
Photo by Paul Thompson.

British machine guns carried on cycles.



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A German field-piece and its firing squad.



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English infantry in France.

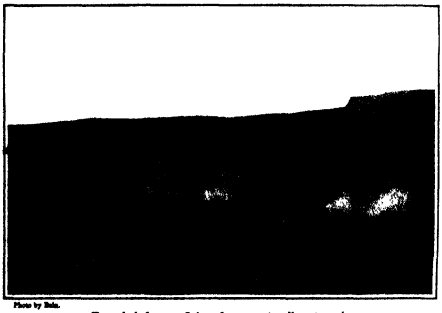


Photo by Rols.

French infantry firing from a standing trench.

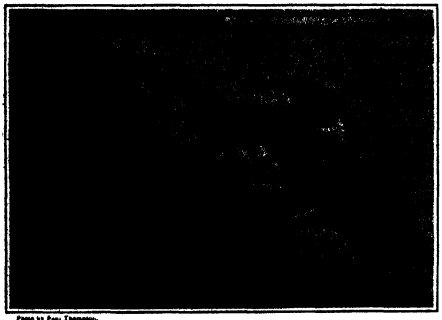


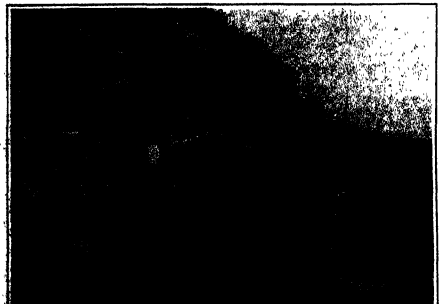
Photo by Paul Thompson.

Landing German cavalry horses after crossing a river.



Photo by Paul Thompson.

How the German cavalry crosses a river.



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Austrian sharpshooters.

said of the British soldier that he is at his best in a tight corner and with the odds against him, and his long service with the colors enables his officers to give him, assisted as they are by a most competent and efficient body of non-commissioned officers, a thorough training in musketry. Both these facts have been proved on the evidence of foreign observers in the present campaign. A German officer, taken prisoner at Mons, said of the infantry fire: "It was staggering; we had never expected anything like it." Withdrawal in face of the enemy is notoriously a most difficult operation, and the danger was heightened after Mons last August by the fact that the enemy was not only fully aware of the critical position of the British forces, but desperately anxious to break down their opposition, and through the allied lines, and pursue their objective—the advance on Paris—against them, with the knowledge that the Russian invasion in East Prussia was all the time making unexpected headway and would soon involve a withdrawal of German troops from France to strengthen the defense of the line of the Vistula. It must be remembered, also, that the men opposed to the British troops were the flower of the German army, troops of which any war-lord might well be proud, and in which the Kaiser justly placed the utmost confidence, and that in numbers of machine guns, field guns, and cavalry (besides infantry in the proportion of three to one, at least) they were far superior to their opponents, and were ably assisted by aircraft in reconnaissance and observation of artillery fire. The quality of the British army and its efficiency were better shown by the skill and tenacity which were displayed in a retirement in face of superior numbers during four days' fighting, August 23-27, under extreme pressure from the enemy than by the most brilliant victory under more favorable conditions. Not a gun was lost of which the horses had not all been killed or the gun itself destroyed by the enemy's high explosive shells, and though the British casualties were estimated at between 5,000 and 6,000 men the enemy's losses were enormous and out of all proportion to those they caused. It is a tribute to British military organization that not only was the mobilization of the expeditionary force and its dispatch to the Continent effected with complete smoothness, but that every gun lost in the four days' fighting referred to above was immediately replaced by another and the losses in men were made good by reinforcements of double the number in readiness for further fighting.

The British Army in War.

The British Expeditionary Force sent over to the Continent, which is sharing the brunt of the most violent and deliberately calculated onslaught of carefully disciplined, picked, and well-equipped troops in superior numbers which has ever been delivered in the history of armies, consisted of men in the prime of life for fighting purposes as regards the majority, of good physique and perfect condition, led by officers, of whom many have had considerable experience in war, though, of course, not of continental warfare. Their equipment was complete in every detail; the rifle, a magazine Lee-Enfield, is an excellent one; the field guns are good, the heavy 60-foot field-guns exceptionally so. The training of all arms has been, since the Boer war, more thorough, more practical, and more elastic than at any previous period of history since the introduction of the modern magazine rifle. Both cavalry and infantry realise the importance of rifle-fire, and while always ready to make the utmost use of the "arme blanche" on occasions, know that it is the bullet (rifle or shapnel, but especially the former) which wins battles, however useful the saber, the lance, and the bayonet may be at critical moments. The cavalry, according to French accounts, which are supported by British official reports, have fought magnificently against superior odds; even their own officers are said to have been astonished at the Berserker-like fury of their onslaught. It has been

Russia and Her Forces.

We now come to the third and largest army of the Triple Entente—the Russian. It is organized in twenty-seven army corps; we know that its peace strength alone is 1,500,000 men, and the source of supply of human material is practically limitless. As many men as can be organised, officered, and made use of in the fighting line can be produced from the inexhaustible reservoir of the Russian Empire, and this human material is of magnificent quality. The results of the Russo-Japanese war are no guide to this quality, for there the previous training of the rank and file was defective. In the valor of ignorance, they despised their adversaries, and the staff and regimental officers were behind the times. That all this has been changed is shown by the progress made by the Russian attack on Germany's eastern frontier. Russia is only just beginning to use up the very fringe of her resources in able-bodied men with the colors.

As regards organization and mobilization, the Muscovite army has been a disappointment to its enemies; the extreme slowness of its mobilization was apparently reckoned upon by Germany as a prime and reliable factor, enabling the latter, with Austria-Hungary, to deal with France single-handed and demolish the resistance of the French force by quicker mobilization and superior strength, before

the Russian troops were in sufficient force to make their influence seriously felt on Germany's eastern frontier. This has turned out to be a miscalculation. The immense distances to be traveled by Russian troops mobilizing have been covered in a surprisingly short time; their advanced guards came into action at the very beginning of the campaign, and, thanks to the unforeseen check offered to the German advance by way of Belgium, the Russian menace had become a reality to be dealt with most effectively and immediately while the bulk of the German forces were still expending their strength in the endeavor to drive a wedge into the allied troops defending the French frontier. Judging from the Russian successes thus far against both Austrian and German adversaries, it would seem as if their training and general efficiency were equal to their spirit, which by all accounts is admirable, for this war, unlike the struggle with Japan, is notoriously a *popular* war, and the reported deficiency in skilled officers which has been attributed to the Russian army may turn out to be less serious than was supposed.

Belgium's Gallant Troops.

The Belgian army numbered 250,000 men when mobilized; their troops had done no fighting since 1815, and until the events of this campaign it would have been difficult to form any opinion of their efficiency, especially in field troops, though it was recognized that the government had done much to organize in defense of Belgian neutrality and the integrity of the national life, and those of us who have noted the change of conditions of service in their armed forces since 1906 and the earnest desire for efficiency given utterance to in such papers as the *Militaire Belge*, realized that the Belgian defense against Teuton aggression, which was foreshadowed by the building of strategic railways in Germany right up to the Belgian frontier in obvious preparation for the events which have now occurred, might be a very serious matter for the invaders. The result has more than justified this forecast; the Belgian army has fought splendidly and desperately. Not only has the defense of Liege covered the troops which took part in it with undying glory, but the Belgian forces have taken the offensive against the invaders, fought stubbornly in the open against odds, and retired only before overwhelming forces in order to make fresh efforts under more favorable conditions, in accordance with a plan of campaign worked out in conjunction with their allies.

From a military point of view, in the peculiar circumstances in which it came into play at the very outset of this gigantic campaign, it will probably be found that the efficiency of the Belgian army has been the pivot upon which the course of the operations has turned, since it must indubitably have upset all the calculations of the German strategists and given time for *other factors to come into play*.

Servia: The Cause of the Trouble.

The quality and efficiency of the Servian army was shown first in the Balkan campaign and confirmed in the resistance offered to the superior strength of the Austro-Hungarian troops in the fighting in the battles of the Drina River, when they routed an Austrian army of 110,000 men, of whom 25,000 were killed and wounded and 10,000 taken prisoners, together with 40 guns and large quantities of stores. The hearts of all ranks are in the fighting, the physique and condition of the men splendid, and the staff and regimental officers have profited by the lessons taught in the operations against Turkey, and they are keen and highly trained. The Servians are armed with the 7-millimeter Mauser rifle and Schneider-Canet artillery, and should be able to put about 450,000 men in the field.

The Kaiser's Spendid War Machine.

The German army is unquestionably a splendidly organized fighting machine, consisting of some 5,000,000 men on a war-footing, with a number of cavalry divisions. The infantry are armed with the Mauser rifle of 0.311 caliber, the field artillery with Krupp quick-firers, which are more numerous but considered inferior to the French and British field guns, and they have an ample supply of heavier guns and howitzers which have been brought into play during the present war with striking effect, notably at Charleroi. Their machine guns are also numerous and have done great execution. The gunners are well trained and have been ably assisted by aerial reconnaissance, but they have gained results by an immense expenditure of ammunition and superiority in the number rather than the quality of their field guns.

According to reports from eye-witnesses, many of the Krupp shells failed to explode. The efficiency of the heavy, long-range artillery, including howitzers, has been proved beyond a doubt. The German cavalry have made their influence felt in all directions in the present war on account of their great numbers; as horsemen and as horsemasters and scouts, they have not the reputation of cavalry in other armies, and the spectacular charges, knee to knee, in large bodies, which are carried out at German mazeuvers against unbroken infantry, are likely to have hecatombs of dead horses and riders as their only result in war. In the charge of the German Guards Cavalry against the Twelfth British Infantry Brigade, for instance, the former were thrown back with great loss and in absolute disorder.

The infantry are remarkable for their steadiness and discipline in close formations, their drill is excellent, and in these same formations they have advanced upon the enemy in overwhelming masses, wave upon wave, with the utmost bravery and in spite of appalling sacrifices, the officers setting the example with admirable courage and devotion. Whether such reckless marching to destruction can be carried out later in the campaign remains to be seen. The German officer, efficient, well instructed, courageous, and proud of his profession, appears to rely upon a carefully organized, mechanical discipline and training, but the discipline is so hard and fast that it discourages individuality and initiative to a great extent and ignores the personal factor. They have great power of punishment on their men in peacetime, and rightly so, for they have to teach them much in a short time; but the natural tendency is to exalt the power of discipline at the expense of elasticity of training.

The German discipline has so far been maintained while the troops are acting on the offensive and know themselves to be superior in numbers and in weight of artillery to their immediate opponents. The German army has felt assured by its successes against the Danes, the Austrians in 1866, and the French in 1870-71, that its system was the best in the world, and so long as it kept up-to-date in arms and equipment, it would continue invincible. It seems to have underrated the opposition which could be offered by the troops of other nations armed with modern weapons, well organized and trained and fired with resolution to defend their country against aggression. So far, their military machine has apparently done all that could be expected of it. Their elaborate system of espionage appears to have given them ample information of things concrete, such as to arms, equipment, numbers, and dispositions of troops, but it could not inform them of the spirit in which their attacks would be met or of the action which various nations would take in opposition to their plans. Now that their forces have been checked, even if only temporarily, and the calculations of the General Staff have been upset, the army has still done all that is possible to make good the loss of precious time, and has struck formidable blows in further pursuance of its aggressive strategy, it remains to be seen how its organization will stand the pressure which will soon be applied relentlessly by its enemies on all sides, and how it will survive the ordeal of acting on the defensive.

There is one apparent weak point which is worth referring to with German organization—the food supply. The German soldier is not so constituted as to work on short rations; the General Staff seems to have counted upon feeding the troops by requisition during a presumably rapid advance through the enemy's country. Whether, when their time-table was upset and their forces were checked, they found it necessary to give priority to bringing up their heavy artillery and communication columns and supporting units, rather than food for those already at the front, it is impossible to say, but various accounts tend to prove that from the first the food supply has been precarious and insufficient, and German prisoners are said to have shown an equanimity and resignation to their fate as prisoners of war, which is not to be entirely accounted for by the relief felt by the average conscript on finding that he is "out of the hurly-burly," that he has done what his country required of him, and is not anxious to begin his experiences of active service in the field afresh.

The scarcity of food in the German armies is in sharp contrast with those of their opponents, whose troops appear, on the whole, to have been systematically well supplied.

One noticeable feature of the German organization which might be copied with advantage is the use of motorcars for the transport of machine guns. Both the Germans and the allies have made free use of motors for transporting infantry from place to place, in order to make good losses and reinforce threatened points, but the Germans, in addition, have succeeded in mounting their powerful 28-millimeter Krupp howitzers for motor transport, by arranging that the gun and its recoil mechanism shall travel on separate vehicles, each with its own motor power. Presumably it was this quality of transport which enabled them to bring these weapons into use against the forts at Namur; and the surprisingly short time in which they reduced some of the forts to ruins and were enabled to press on their advance, in spite of the resistance offered by the latter, may thus be accounted for in great measure. They have also provided themselves with an excellent equipment of portable searchlights for the illuminating of the field of fire and the guarding of railway lines by night, which have been of great use.

[illegible]

The [illegible] on a war footing, is 2,750,000 men, [illegible] series of field artillery, 36 howitzer [illegible] machine batteries, and 45 ammunition [illegible] The general strength is said to have been seriously reduced by desertions and by reservists failing to [illegible] mobilization. In addition, the infantry are composed of many varying nationalities with little in common between them, in many cases not even language, so that, although its training is conducted more or less on German lines and by good officers, it is doubtful whether the army, which has not fought since 1866, will stand the crucial test of what is rapidly becoming a defensive war under depressing conditions. So far, the troops sent against Servia have signally failed in their mission, and have been withdrawn from that portion of the theater of war with great loss of men, guns, and prestige. As allies, the Austrians have, no doubt, enabled the Germans to concentrate their troops against the French at decisive points, and they have fought desperately in order to strike at the Russian position in Poland, and appear to have suffered heavy losses in the process without succeeding in stemming the tide of Muscovite invasion. Their infantry are armed with the 0.315 Mannlicher rifle, but the reports from that portion of the Continent in which they are fighting against the Russians are so meager and conflicting and give so little useful detail that it is impossible to judge of their efficiency or of that of the cavalry, who have, however, enjoyed the reputation of being excellent.

In conclusion, it may be said the data upon which to judge of the performances of the aircraft of any of the armies engaged in this war are at present quite insufficient. Aerial observation of artillery fire has undoubtedly been of advantage, notably to the Germans; but otherwise, beyond the fact that overhead reconnaissance, while freely carried out, does not seem to have affected the conduct of operations to any such extent as many critics expected it to do, it would be unsafe to generalise.

Some of the Tendencies of Eugenics

FROM the way that eugenics has been treated in the public prints, most people have the impression that it is a simple method of improving the human race which involves only the temporary inconvenience of a few sentimental persons who desire to pair off without regard to the principles of science; but much more is involved besides the matter of restricting marriage, and some of its far-reaching results may be inferred from remarks by Prof. William Bateson in his address on "Heredity" before the British Association at its Australian meeting, in which he says: "Everyone must have a preliminary sympathy with the aims of eugenists, both abroad and at home. Their efforts, at the least, are doing something to discover and spread truth as to the physiological structure of society. The spirit of such organizations, however, almost of necessity suffers from a bias toward the accepted and the ordinary, and if they had power, it would go hard with many ingredients of society that could be ill spared. I notice an ominous passage in which even Galton, the founder of eugenics, feeling, perhaps, some twinge of his Quaker ancestry, remarks that 'as the Bohemianism in the nature of our race is destined to perish, the sooner it goes the happier for mankind.' It is not the eugenists who will give us what Plato has called Divine releases from the common ways. If some functor with the catholicity of Shakespeare would take us in hand, well and good; but I would not trust even Shakespeare's meeting as a committee. Let us remember that Beethoven's father was an habitual drunkard, and that his mother died of consumption. From the genealogy of the patriarchs also we learn—what may very well be the truth—that the fathers of such as dwell in tents, and of all such as handle the harp or organ, and the instructor of every artificer in brass and iron; the founders, that is to say, of the arts and sciences, came in direct descent from Cain, and not in the posterity of the irreproachable Seth, who is to us, as he probably was also in the narrow circle of his own contemporaries, what naturalists call a 'nomen nudum.' Genetic research will make it possible for a nation to elect by what sort of beings it will be represented not many generations hence, much as a farmer can decide whether his byres shall be full of Shorthorns or Herefords. It will be very surprising, indeed, if some nation does not make trial of this new power. They may make awful mistakes, but I think they will try. There are races who have shown themselves able at a word to throw off tradition and take into their service [illegible] power that science has yet offered them. Can we suppose that they, when they see how to rid themselves of this ever-increasing weight of a defective population, will hesitate? The time cannot be far distant when both individuals and communities will begin to [illegible] terms of biological fact, and it behooves those who [illegible] scientific thought carefully to consider whither [illegible] should lead."

Correspondence

The editors are not responsible for statements made in this correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.)

Are Good Roads on Bridges Impossible?

To the Editor of the SCIENTIFIC AMERICAN:

Doubtless many people who observe and who have had occasion to use, particularly, the Williamsburg and Manhattan bridges in their automobiles, have noticed that the roads across them are almost continuously destructive. They are not only extremely rough and bumpy, but torn up nearly all the time for the purpose of repairs, which, of course, causes constriction to the stream of traffic.

Considering that these structures cost the city tens of millions of dollars, it appears rather strange that roads of such poor quality can be built and maintained on them.

I have often wondered whether the resources of road science have been exhausted on these important highways, and if not, why not. If said resources have been exhausted, undoubtedly some expert in Europe could solve the problem. A fee of a million dollars would not appear to be excessive for the city to pay him, considering the great investment that has been made in the supporting structure itself.

Since speaking of roads which are now being recognized as such important factors and upon which vast sums are spent, I have taken particular notice of the ultimate results produced by the use of oil as a dust layer.

I have seen the time when Long Island had a great many plain dirt roads which were as smooth as a wooden floor, but since oil has been used on them, they have become almost impassable, in that they are humpy. This is caused as follows: When it rains, water cannot penetrate except in certain places, usually where there is less oil, or in slight depressions where mud is formed. With the passing of vehicles, the dirt in solution is washed out, making the ruts deeper and deeper until the road is ruined.

I have thought that it might be well worth while for the State to experiment with a view to overcoming this difficulty. An addition of potash or caustic soda, which would slightly saponify the oil so as to permit the rain to penetrate more readily, would appear to counteract the destructive effect now caused by oil alone.

New York. ALBERT F. SHORE.

Lightning and the Automobile

To the Editor of the SCIENTIFIC AMERICAN:

In I note on page 173 of the SCIENTIFIC AMERICAN SUPPLEMENT No. 2019 a short paragraph on safety during thunderstorms, which refers to a fallacy that a motor-car is one of the safest places in which to take refuge. Is it not about time that the conception that our standard insulating materials afford protection against lightning should be discarded? Of what value is the insulation provided by a number of inches of rubber when the potentials to be dealt with are of the order of millions of volts? Then again, a very appreciable shock can be obtained from a magneto through electrostatic capacity so small as to prevent the passage of a heavy lightning discharge. In other words, should a lightning discharge strike a motorcar, it is reasonably certain it would flash across the tires and not flow as does the current of the magneto in the case cited.

The value of any object as a "protection" against lightning lies not in its ability to provide a path of high insulating value, but to provide around the human body a *short* path of lower resistance than the body itself. Persons taking refuge under trees during a thunderstorm are struck because their bodies provide a path of lower resistance than an equivalent length of the tree-trunk; consequently, the lightning, following the path of least resistance, "side-flashes" to their bodies in preference to taking a direct course to earth.

As regards the motorcar: If a person should lie down in it or if it is provided with metal extensions, such as the supports of a canopy top which projected considerably above the occupants' heads, there would probably be little danger of death by lightning since a discharge striking the car would pursue its course to earth over the metal work, unless the latter was so light as to be fused completely disintegrated, though it is quite likely that the occupants would receive severe shocks from the current equalizing the electrostatic capacity of their own bodies as well as burns from the flash. On the other hand, if it were an open car with top down and the occupants' heads projected above the top of any metal work, it is not unlikely that they would receive a direct strike, provided lightning conditions predetermined the discharge in a downward direction.

[illegible] with electric discharges of [illegible], as performed in the laboratory, will speedily convince anyone of the truth of the above statements.

Wilmington, Del. L. A. DEBLOIS.

Pitching Baseball Curves

To the Editor of the SCIENTIFIC AMERICAN:

I was surprised to see, in a recent article in the SCIENTIFIC AMERICAN, a correspondent discrediting facts and theory in regard to pitching baseball curves. Evidently the correspondent, Irwin, and his professors are not acquainted with that admirable article, "The Dynamics of a Golf Ball," by Sir J. J. Thomson, in the SCIENTIFIC AMERICAN for February 11th, 1911. Or, if familiar with it, probably they doubt the truth of this great scientist's words.

Pronounced curves can be described by anyone by grasping a lath or yardstick in the middle and imparting a rapid twirl as the stick leaves the fingers. The correspondent says he failed to throw any curves; if he would practise with sticks, tennis balls, or ping-pong balls, I believe he will meet with success. When throwing a curve the ball leaves the thumb first and *rolls* off the fingers, hence the angular velocity will equal the linear velocity of the ball. That side which left the fingers will possess no relative motion to the air, therefore no extra pressure will be exerted against that side. On the opposite side the relative motion amounts to the sum of the velocity of the ball and the velocity of spin. Fig. 1 illustrates the relative motion of points on the surface of a ball whose velocity is 100 feet per second. The pressure on these points increases in like proportion, and as a result of the one-sided pressure the ball deviates; nothing could be simpler. Fig 2 illustrates the reversal of Fig. 1. A ball or cylinder is placed under a stream of air or water; it will be forced out owing to the one-sided pressure.

According to the correspondent's words concerning Irwin's experiments, I am not surprised that he failed to find light on the subject. The body should not *fall* through a liquid of various densities, but should be

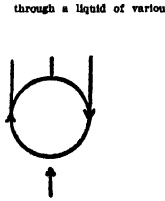


Fig. 1.

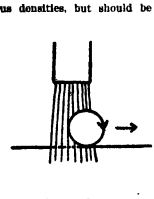


Fig. 2.

shot through horizontally. The body must be denser than any liquid used.

Facts and theory prove that parabolas and arcs of circles can be described by throwing bodies having different properties. The velocity of a baseball and the velocity of spin are practically constant throughout short flights, hence an arc of a circle is described. The velocity of a stick or ping-pong ball and the velocity of spin are rapidly retarded and a parabola is described. If the body could remain in the air until the angular velocity was zero, it would assume a straight-line course.

I have never seen "serpentines" or "floating corkscrews" described with a baseball. In order to produce such a curve, the ball must rapidly rotate in a plane at right angles to the direction of flight. It is not impossible to impart this rotation with the hand, but it is of such a low order that no perceptible deviation occurs.

The erratic and uncertain behavior of twirling balls after bouncing is easily explained. Two forces act on a twirling ball while in flight and at the instant of bouncing: the force of linear velocity and the gyroscopic force of rotation. In different balls these forces will be differently related, depending on their construction. It is an everyday occurrence to see a tennis ball bounce erratically; it is done purposely and unintentionally on the court. But a baseball is seldom seen to bounce erratically for this reason: a baseball seldom acquires a gyroscopic force exceeding its bouncing force, and hence will bounce in the expected direction. The gyroscopic force of a tennis ball far exceeds its bouncing force, hence bounces in obedience to this force. On the other hand, I have seen heavily fouled baseballs, on striking ground, dart off in an unexpected direction, the heavy blow from the bat imparting sufficient gyroscopic force to the ball as to exceed the bouncing force.

Monticello, Ind. RUSSELL B. CLAPPER.

"Suspending Life"

To the Editor of the SCIENTIFIC AMERICAN:

Anent the article under the above title in your issue of August 12th, I desire briefly to consider the third paragraph. The writer, M. Becquerel, is too well known to have his standing as a scientist questioned, and his brilliant experiments are not only classical, but of the highest importance. But his conclusions concerning life are such as many sense-bound scientists, who are not philosophers, are prone to reach. Because, in his experiments, under the abnormal conditions of low temperature and vacuum the vital *activity* of an organism stops, or disappears, it does not follow that life has been annihilated. Observation here is necessarily limited to physical phenomena, as in science generally. It would be as logical to say, when a weaver stops his loom because of excessive heat, or cold (as in the experiments referred to), or when he goes to lunch (the vacuum (?) condition), that the weaver is dead. So far as his activity is observable in the evolution of his product, as a rug, garment, etc., there is absolute suspension, or, what corresponds to life, viz., weaving, in the illustration, is dead. But of course on resumption of work by the weaver, the weaving goes on as before the suspension.

Dr. Becquerel, with other scientists like him, ignores *a priori* knowledge, or what is directly and positively known by experience, and depends solely on the knowledge of inference, through observation and the senses. But the latter is trustworthy only for the phenomena of matter.

Life, which may be provisionally defined as the organizing faculty of mind, is of an order of being not discernible through the senses, and of course cannot be seen, measured, or weighed.

When Dr. Becquerel or anyone else has demonstrated that the directive impulse which evolves a frog from one germinal cell and a man from another is found and defined in the constitution of matter, or in the reactions of chemistry, there may be some ground for assuming that life is nothing more than an imaginary entity, and not until then.

It may be added that the experiments of Dr Becquerel from a scientific standpoint, *are not crucial*, for the reason that the conditions of temperature and vacuum imposed on the organisms are not absolute, but merely extreme or approximate. It has not yet been determined what would be the conduct of matter of any kind at absolute zero of temperature and in absolute vacuum.

W. H. HOWARD,
Of the Examining Corps, U. S. Patent Office.
Washington, D. C.

The Fallacy of Eternal Youth

To the Editor of the SCIENTIFIC AMERICAN:

A quarter century has passed since Brown-Sequard launched a goat's lymph theory of everlasting life. So it is with those who have moistened their lips by a new sensation, after the inconveniences and pains and aches of age set in, they look about for a "Fountain of Youth," or becoming reconciled to the inevitable, seek by fair or foul means some sort of intercourse with the nether world.

There are topics beyond human understanding, and many theories must be taken upon faith. We cannot explain why and how we entered upon the units of this world we live in, and we cannot explain where and how we are leaving it, save by faith, and the belief in the teachings of those best qualified to advance satisfactory dogmas. Have any of these comprehended fathomless space? Our five senses carry to the brain a few mathematical facts of scientific research, yet we continue to seek, until we must eventually round up at a standstill. In a limited world, there is a limited investigation. The lower animals live their lives, guided by instinct. Man only recently is beginning to know what the birds have known of the air since time immemorial. The study of air rivers, air eddies, calms, storms, electric, etc., is being worked out by aviators. Why not employ more instinct and less scientific investigation, where the seeming impossible is to be surmounted? The conscience of man is an instinct. The conscience rules the higher ego, the appetites the baser ego. Those who have studied conscience, believe that the simplest life we can lead proves the happiest, which goes to show that pseudo ambition is harmful. Napoleon died young, but observe the denizen of a Sahara. In his life-long quiet way of getting close to nature is he not sure of his threescore and ten?

It is plausible to prolong the life of a cell by bathing it in its life-giving pabulum, or by supplying a new cell element at its molecular death. It is possible to preserve a building, by substituting a brick, a stone, a door, or a window for the disintegrated unit, but what an exhausting, troublesome method, when the old structure can so easily be demolished in its entirety, and a new and beautiful one reared in its place. Man's life is continued by his progeny, until it is ordained that man can no longer inhabit this sphere of the universe. With each geological era, a new creature held sway, and then quietly passed into oblivion. Therefore, there is no logic in assuming that the creature man has arrived to stay. J. A. GUTHRIE.

Portsmouth, Va.



Date, 1912 Tons, 21,500 Speed, 20 knots. Guns, twelve 12-inch, ten 6-inch, eight 4.7-inch. Torpedo tubes, five. Belt armor, 12-inch.

Dreadnought "Kawachi"; also "Settsu."

IN estimating the strength and efficiency of the Japanese navy, it is well to make a distinction between the ships which were built previously to the Russo-Japanese war and those built in the ten years which have intervened since that struggle. The fleet possessed by Japan at the opening of the war was thoroughly modern and represented, both in its battleships, cruisers, and destroyers, the latest practice of the British and French naval architects who were responsible for the design of the Japanese ships.

The Japanese war material was good and it was well handled, for it was the common judgment of naval experts the world over that the natural aptitude of the Japanese race for the sea showed itself in the skill and daring with which their fleets were maneuvered and fought in the various operations of the war.

It was one of the remarkable features of that struggle that the Japanese navy emerged from the conflict stronger in *material* than it was when the war began. This was due to Japanese valor and skill in the battle-line and Japanese ingenuity in salvage operations conducted on the sunken Russian fleet in Port Arthur.

With all the experience of the war to guide them, it was to be expected that the new battleships and cruisers built by the Japanese since the struggle should be greatly superior to the older vessels; and so well have the Japanese expended the funds available for new construction, that, in spite of the enormous financial burden laid upon them by the war, the Japanese navy holds to-day the fifth position among the great navies of the world.

The close of the war found the Japanese in possession of eight battleships; and of these four, the "Fugi," "Asahi," "Shikishima," and "Mikasa" were ships which had passed through the naval campaign and survived its perils. The other four, the "Iwami," "Hizen," "Sagami," and "Suwo," had been captured from the Russians.

Of these eight ships, the least valuable to-day is the "Fugi," built at Ellswick in 1896. She carries four 40-caliber 12-inch and ten 50-caliber 6-inch guns, and is protected by a belt of 18-inch Harveyized armor. Her present speed is probably about 16 or 17 knots, and her displacement 12,300 tons. The "Asahi" and "Shikishima," also veterans of the war, were built in 1901 and 1900 in England. They carry four 12-inch, 40-caliber guns, and fourteen 40-caliber 6-inch guns, and are protected by a belt of 9-inch Harveyized armor. Their displacement is 15,200 *tons*. The *present* speed is about 18½ knots. In common with the "Fugi," each ship carries five torpedo tubes. The "Mikasa" will be recognized as Admiral Togo's flagship during the war. She is of 15,200 tons displacement and mounts four 12-inch 45-caliber and fourteen 45-caliber 6-inch guns, and is protected by a 9-inch belt of Krupp armor. Her speed is about 18½ knots. Built in 1900, she was accidentally blown up in 1905, but was raised and thoroughly reconstructed. She is to-day a serviceable ship of the pre-dreadnought type.

Of the other four battleships, the "Iwami," a French-built battleship of the "Czarevitch" class, is of 13,000 tons displacement and 18 knots speed. She mounts four 45-caliber 12-inch and six 45-caliber 8-inch guns, and is protected by a belt of 7½-inch Krupp armor, besides having internal armor as a protection against torpedoes. The "Hizen" is of particular interest to Americans, because it was built at Cramp's in 1902. She was torpedoed at Port Arthur, repaired, and then severely punished in the sortie in August from Port Arthur, where she was subsequently scuttled and then raised by the Japanese and remodeled. She is of 12,700 tons, 18½ knots speed, and mounts four 40-caliber 12-inch and twelve 45-caliber 6-inch guns. She is protected by a belt of 9 inches of Krupp armor.

The remaining two battleships of the eight, the "Sagami" and "Suwo," were built at the Baltic works in 1901-1902. They are of 13,500 tons and 18½ knots speed, and they mount four 45-caliber 10-inch and ten 45-caliber 6-inch guns, and are protected by a 9-inch belt.

Japan possesses a homogeneous fleet of nine armored cruisers, all of which took a very active part in the operations of the Russo-Japanese war. In protection, gun fire, and speed they are very similar; and it is a remarkable fact that Admiral Togo did not hesitate, at times, to place them in the first line of battle. The "Nisshin" and "Kasuga," completed in 1904, and purchased from the Italians, are of 7,750 tons displacement and mount four 45-caliber 8-inch and fourteen 45-caliber 6-inch guns, and are protected by a belt of 6-inch armor. Their speed is about 19 knots. The "Aso," captured from the Russians, was built in France. She is of 7,900 tons and 22 knots speed, and mounts two 45-caliber



Drawn by Oscar Parkes

Date, 1911. Tons, 20,800. Speed, 22½ knots. Guns, twelve 14-inch, sixteen 6-inch. Torpedo tubes, six. Belt armor, 12-inch, 6-inch and 6-inch.

Dreadnought "Fuso"; also "B," "C," and "D."



Date, 1913. Tons, 27,500. Speed, 28 knots. Guns, eight 14-inch, sixteen 6-inch Torpedo tubes, eight Belt armor, 10-inch

Battle-cruiser "Kongo"; also "Hi-yei," "Haruna," and "Kirishima."

8-inch and eight 45-caliber 6-inch guns, and is protected by an 8-inch belt. The six armored cruisers, the "Idzumo," "Iwate," "Aguma," "Yakumo," "Asama," and "Tokiwa" are of about 9,800 tons displacement and 20 to 21 knots speed. They are protected by a 7-inch belt and mount four 40-caliber 8-inch guns and fourteen 40-caliber 6-inch guns.

Since the war Japan has ceased the construction of armored cruisers.

Japan possesses some fine scout-cruisers, the best of which are the three vessels "Hirato," "Yahagi," and "Chikuma" of 5,000 tons and 26 knots speed, mounting six 6-inch 50-caliber guns, and protected by a 3-inch deck. These were completed in 1912. A somewhat older scout is the "Tone," of 4,100 tons and 23 knots speed, mounting two 50-caliber 6-inch and twelve 50-caliber 4.7-inch guns, and protected by a 3-inch deck. These last-named four vessels were built in Japan. The fleet also includes eight second-class cruisers of from 3,000 to 6,500 tons displacement and from 21 to 23 knots speed. These include the "Soya," built at Crump's, sunk at Chemulpo during the war, and subsequently raised and refitted. Her trial speed was 24½ knots, and she mounts twelve 45-caliber 6-inch guns. Another historically interesting vessel is the "Tsugaru," of 6,630 tons, carrying eight 6-inch guns and having a speed of 18 knots, which was sunk at Port Arthur and subsequently salved and reconstructed. Belonging to the pre-bellum period are nine smaller gunboats and cruisers of from 1,200 to 4,200 tons

The Japanese have paid special attention to their destroyer fleet, which numbers fifty-two boats, with two under construction. The fleet is modern, dating from 1900 to 1914, the largest batch of thirty-seven boats having been completed in 1908. The naval list includes fifty-five torpedo boats, and fifteen submarines, with two building. The two under construction are of the "Schneider" type and they are to have a surface speed of 17.5 knots and a speed submerged of 9 knots. The boats of the "Vickers" type have a speed of 13 knots on the surface and 8 knots submerged

The new navy of Japan, dating from the war, consists of large, swift, and heavily-armed ships in which are embodied the experience gained during that conflict The first battleships to be added (in 1906) were two English-built vessels, the "Kashima" and "Katori," of 16,400 and 16,000 tons displacement, respectively. They mount four 45-caliber 12-inch, four 45-caliber 10-inch, and twelve 45-caliber 6-inch guns, and are protected by a 9-inch belt. The presence of the four 10-inch guns entitles these to be placed in the semi-dreadnought class.

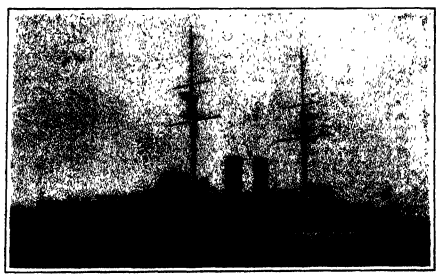
Following these ships come two unique vessels which might be called semi-battle-cruisers, the "Tsukuba" and "Ikoma," of 13,700 tons displacement and 20½ knots speed. They mount four 45-caliber 12-inch, twelve

(Concluded on page 290)



Date, 1910. Tons, 19,800. Speed, 18.5 knots. Guns, four 12-inch, twelve 10-inch. Torpedo tubes, five. Belt armor, 9-inch.

Semi-dreadnought "Satsuma."



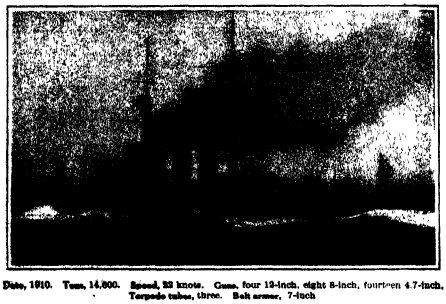
Date, 1906 Tons, 16,000. Speed, 20 knots. Guns, four 12-inch, four 10-inch, twelve, 6-inch. Torpedo tubes, five Belt armor, 9-inch

Semi-dreadnought "Katori"; also "Kashima."



Date, 1907. Tons, 22,500. Speed, 23.5 knots. Guns, four 12-inch, twelve 6-inch, twelve 4.7-inch. Torpedo tubes, three. Belt armor, 7-inch.

Semi-battle-cruiser "Tsukuba"; also "Ikoma."



Date, 1910. Tons, 14,800. Speed, 22 knots. Guns, four 12-inch, eight 8-inch, fourteen 4.7-inch. Torpedo tubes, three. Belt armor, 7-inch

Semi-battle-cruiser "Ibuki"; also "Kurama."

A Modern Military Camp

Various Methods of Building Temporary, Permanent or Winter Shelters

A MODERN military camp is far more substantial in character, far more ingeniously planned than the layman realizes. It may be only temporary, in which case it is constructed by the troops in the field themselves, or it may be of a fairly permanent character, in which case it may be built both by soldiers and civilians under the guidance of the engineer corps, or as they are known in Europe "pioneers." The simplest of all camps are those which are used simply for bivouacking, and the most elaborate are those in which huts and barracks are used in order to provide some measure of protection against the weather.

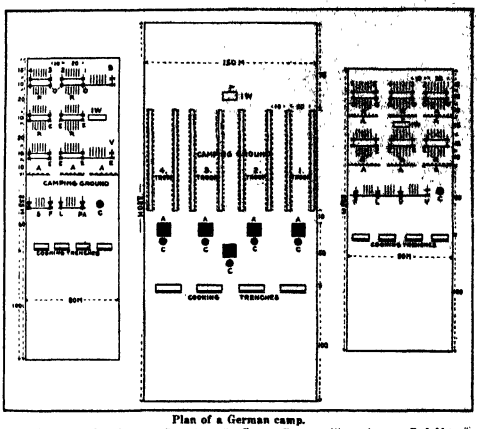
Obviously the most useful protection against weather is the well-known army tent. In erecting tents, the general direction of the wind prevailing about a camp is ascertained, and the tents are pitched in lines parallel with the wind's travel. In order to shield the troops from wet and cold soil, a wooden floor is ordinarily provided, the necessary material being found either on the camping ground itself or being carried along from the last camp.

Circular wind screens, surrounded by a ditch, are to be found in many military camps as a protection against storms. These screens are built by driving in piles to a height of three feet, the piles being connected by ropes of straw or grass. Against this straw, branches or the like are piled so as to make a wall, which is held in place by a layer of earth at its foot (Fig. 1). If long poles can be obtained and much covering straw, panels from seven to eight feet can be tied together and supported by poles, as a protection against the wind (Fig. 2).

Camp huts are most easily made by tilting two wind screens against each other in the manner shown in Fig. 2, the angle at the ridge being 60 degrees. Assuming that the height of the ridge from the ground is 9 feet 4 inches, the interior will have a breadth of 16 feet 5 inches, or room enough for two rows of cots and an aisle a yard broad. The beams are of the type shown in Fig. 6. Boards may be laid upon the beams and covered with tar paper. One gable end is closed and the other provided with a door. In order to keep the hut dry, draining ditches are dug [illegible] into which the rain flows. Around [illegible] hut earth is packed so as to keep out [illegible] are usually not less than 20 feet long [illegible] dations for 20 men) and not more than [illegible] (with accommodations for 32 men). [illegible] built in at the same time as the huts [illegible] the Austro-Hungarian army. A [illegible] hut of straw (Fig. 3) [illegible]

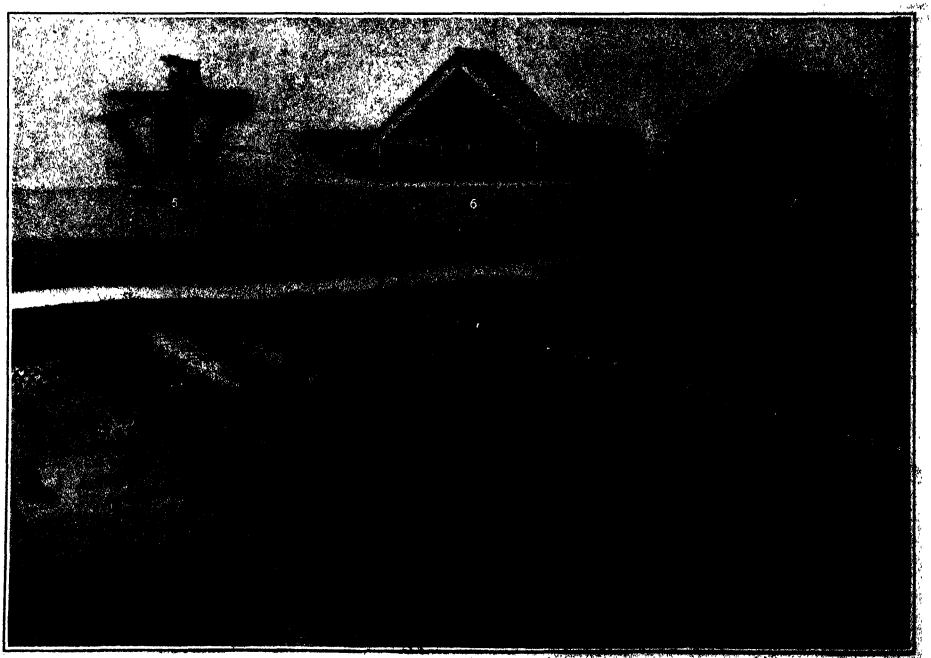
Winter huts are of various types, but their construction is much the same as that of the ordinary hut, with the exception that stronger beams and heavier sloping roofing is employed. Protection is particularly necessary because a layer of earth overlies the entire hut. Such huts are built in the [illegible] not more than 2½ feet deep, [illegible] beams. An iron stove [illegible] the interior, or a stove [illegible] turf, or the like. If [illegible] not be readily obtained, [illegible] and meat cans are fashioned into a pipe. When the hut is built in a deeper excavation, a sloping roof is employed as shown in Fig. 4, composed of several layers of earth and wood. This heavy roofing is necessary to protect the men within the hut from shell and shrapnel fire.

Instead of huts, barracks may be constructed with vertical side walls. They are built with buried posts or stanchions. Joists or joined boards may be used for the posts. The walls are boarded up both from without and within, and the hollow space between is filled with turf, moss, earth, and the like, as a protection against heat or cold. Window openings may be provided as may appear necessary. In winter the



Plan of a German camp.

A, baggage and equipment. *B*, sentry. *C*, officers. *E*, ammunition caissons. *F*, fodder. *L*, provisions. *W*, guards. *O*, guns. *PA*, baggage wagons. *R*, stalls. *S*, blacksmiths. *V*, supplies.



General view of a German military camp.

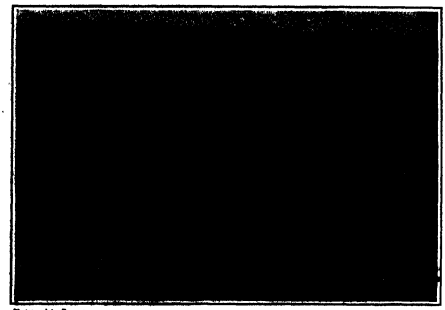
The small views above illustrate the construction of a well (Fig. 5), a permanent camp hut of wood (Fig. 6), and the cooking arrangements (Fig. 7).

...ed with earth up to the gable ... to joined to the barracks. They ... sloping roof, or the gable roof type ... to horse boxes, the attendants to ... as harness, fodder, and the like.

... inches 1½ to 2 feet in depth and 3¼ ... ing are used. In one side wall five ... shown in Fig. 7. The excavated earth ... ment to form a windshield. If there ... ar containing kitchens which can be ... built of brick or of limestone and ... masons can build such a hearth in ... ed bricks and cover the whole ... roof. For a single company (squad- ... three caldrons of 176 quarts capacity ... be provided.

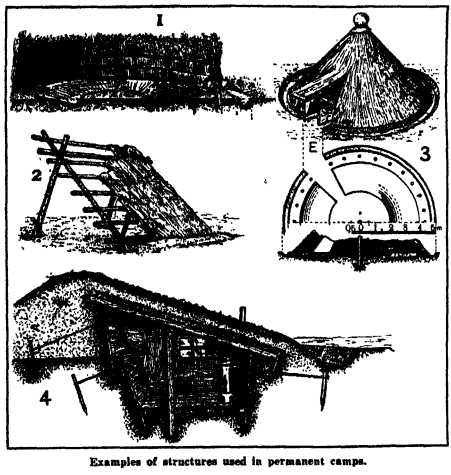
... ovens must be built if necessary by the field ... order to provide the troops with ... For this purpose the iron framing ... the field bakery column always carries with it is employed. Mortar, sand, ... must be obtained on the spot. ... the Prussian army the iron framing of ... oven is built in with the brick and ... can be removed except by breaking the ... away. In other armies it may ... simply as false work to be removed ... the oven is completed; but in this ... it is harder to build the oven. The ... is always first constructed, with ... ay rise toward the rear. Stone, ... etc., are used in the foundation, and ... vault of brick completes the masonry. ... rear end a chimney is built and at ... forward end draft holes and other ... openings are provided. A pro- ... roof covers the hole. The oven is ... completely protected by clay, stones, ... and the like.

The water supply of a camp is a mat- ... of great importance. Only running ... is used. In the German army the ... water is used for drinking pur- ... and the down stream water for ... horses and for bathing. Suitable ... notify the men which water is safe ... drink and which may be used only for ... bathing. In shallow or narrow streams, ... are dug or small dams built so as ... form a reservoir of ample dimensions. ... stones are provided to keep the ... clean, as well as board protection ... prevent the banks from crumbling. ... are dug for watering horses; ... are provided only in case of ne- ... and are then propped on posts ... filled by means of pumps. Pipes may ... driven if water lies at a reasonable ... in other words not more than 20 ... Depending upon their size, these ... will deliver from 4 to 22 gallons of ... per minute. If water lies very ... the surface a hole is dug and a cask, ... bottom of which has been knocked ... is placed in the hole to form a basin. ... water lies at a greater depth, the ... may be formed of box sections, ... in one on top of the other, in posi- ... (Fig. 5). If the depth is greater ... 3 meters, a kind of shaft must be ... the wooden sections being driven in ... after the other, the opening at the ... being greater than that at the bottom. ... water is then raised by means of a ... pump.



Photograph by Bongen.

A German military camp at Visé.



Examples of structures used in permanent camps.

Fig. 1.—Screens for protection against wind. Fig 2.—Another style of wind screen, that can be converted into a shelter Fig. 3.—Elevation and plan of round straw hut, adopted by the Austrians. Fig 4.—Sunken winter hut, usually constructed in intrenchments. (Illustrations from *Handbuch für Heer und Flotte.*)

Random Reflections

By Our London Correspondent

I'VE been reading von Bernhardi's book "Germany and the Next War" and have been much interested in the way it is written. As is usual with German books, a philosophical introduction precedes the really business-like section, but with Bernhardi the philosophy strikes me as exceedingly perfunctory. It is so obvious that in writing it he is merely conforming to one of the Fatherland's traditions; that awful German tradition governing the construction of books. In my time I have browsed gently in one or two philosophic pasture lands, finding the food, as a rule, a little thin and not quite adapted to my particular digestive apparatus, although occasionally, by judicious nibbling, one gets a little nourishment; but never before have I tried to make a meal off such shockingly poor fare as Bernhardi serves up in his first two chapters.

He calls them "The Right to Make War" and "The Duty to Make War." It is not necessary to say much about these chapters; there can be but few people in the United States who would trouble to read long arguments having such titles. After all, except from curiosity and if I had nothing else to do, I wouldn't read a long proof that twice two is five or that the earth is flat. As Huxley once remarked, one doesn't reach years of discretion without definitely deciding that some things are not worth examining. But there are little touches of unconscious humor about Bernhardi which help the bored traveler along the stony labyrinths of his argument. At the bottom of page 53, for instance, he makes the handsome admission: "War is not always the final judgment of Heaven."

The rest of the book seems to be written with more gusto; he leaves the realm of theory for that more interesting and congenial region, the region of partial facts. He is a great man on numbers: number of men, number of guns, number of horses, number of ships, and extent of territory. He knows the relative fighting powers of all nations reckoned in "men put in the field"; he arranges his figures and draws conclusions. He seems to me to have left something out; he nowhere estimates the relative fighting power of different ideals. I cannot help thinking that what a man fights for has something to do with the way he fights. Would a German, fighting to impress his superior culture on that barbarous nation, the French, fight quite as hard as a Frenchman fighting to preserve his home inviolate, to keep his passionately loved France a nation, to prevent a repetition of the horror and humiliation of 1870? Surely the passion to proselytize the missionary fervor never reaches quite such heights as these. And then those low-class mercenaries called English soldiers and sailors—well, they seemed to think, in their uneducated way, that Kaiser Bill is trying to rule the roost and, knowing nothing of the advantages of the German culture, they object. They object quite strongly; so strongly that it is doubtful whether anything like an equal number of German missionaries could ever persuade them.

I really think that sort of thing matters. Of course, one must have a rifle. Well, Bernhardi knows how many rifles everybody has got. Having your rifle, it is useful to be able to point it approximately in the direction of the thing you want to hit; a fact which has apparently been a little overlooked in the German army; but also the spirit in which the man with the rifle pulls the trigger must have some bearing on the result.

The fact is that Bernhardi is a German military theorist and is tremendously in love with the German military machine. One can understand this. Any big, efficient machine is attractive. Marine engineers and central station engineers often have a positive affection for the machines under their control. To some extent this explains the invasion of Belgium. To respect the neutrality of Belgium would be to impair the efficiency of the German war machine. In a way, it offends one's artistic sensibilities. Here is a scheme, an ingenious, perfected, finished scheme, a beautifully symmetrical, artistic whole, and you ask me to ruin the whole thing by leaving out a part of it!

It is the fault of specialization all the world over. One's sense of proportion becomes distorted. Nothing matters very much except one's own particular job This indifference and exclusiveness is very marked in scientific men, not only where the *arts* are concerned, but even where other branches of science are involved. I knew an old professor of physics who used to refer to "botany and the other occult sciences." Bernhardi has come to think that the German war machine is the most interesting and important thing in the world, not because he is a wicked German, but merely because he is a human being who has specialized on the German war machine. There are plenty of people just as ill-balanced, only their mental center of gravity happens to be situated elsewhere: Christian Science; writing novels; astronomy; or should women have the vote. A specialist is useful when one wants information about his particular pet subject, but when he endeavors to define the relations of his subject to other subjects, he generally makes a bad mess of it. They are all a little like the Cambridge senior wrangler who was asked what he thought of Milton's "Paradise Lost." He said he liked it in a way, but he couldn't see what the author was trying to prove.

Germany is a specialist on a big scale and has all the specialist's faults on a big scale. Its errors, quite naturally, are also on a big scale. The invasion of Belgium was very fit and proper from the point of view of the military specialist, but a horrible blunder from the point of view of everybody else. I hope this example will make specialists more humble, but I doubt it. They are a proud and stiff-necked race. But in future, instead of wilting under a sense of inferiority, I, for one, in presence of the specialist's complacent serenity, will watch, with perhaps a faint stirring of pleasurable anticipation in my degenerate heart, for the premonitory symptoms which indicate that once again a specialist has come a fearful cropper.

Cellulose Sponges

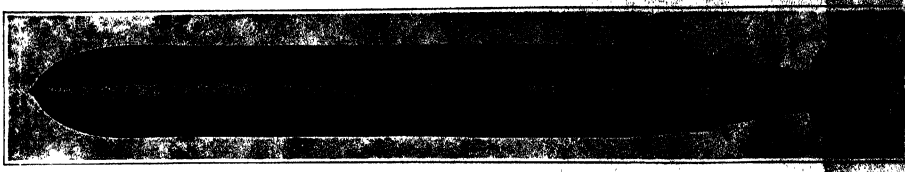
RUBBER sponges as a substitute for the natural article have long been known. Now we are to have them made from a product of cellulose called "viskose," which ought to make them considerably cheaper. Viskose is the xanthogen acid ester of cellulose, and the process is thus described in *Umschau:*

The viskose is stirred up with an aqueous solution of caustic soda into a homogeneous fluid. This is allowed to stand for several days (the so-called ripening of the viskose) and kneaded with strands of hemp cut into finger-lengths to form a "fiber dough" Into this are evenly stirred crystals of Glauber's salts. The size of the crystals corresponds to the size of the pores desired in the finished sponge. This dough is then shaped into round or oval pieces of suitable dimensions.

Finally, the sponges are immersed in water, which dissolves the crystals of Glauber's salts, leaving the corresponding pores. The whole process consumes some six weeks.

Torpedo Warfare

Description of the Mechanism by Which the Torpedo is Driven Unerringly to Its Mark



One of the latest types of the Bliss-Leavitt torpedoes, showing the three separate sections of the torpedo in their assembled condition ready for [illegible]

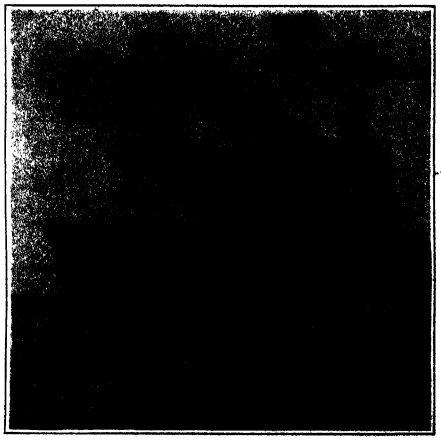
IN the present stage of its development there are three methods by which the automobile torpedo is started on its destructive flight. First, it may be discharged through the side of a battleship or cruiser at a depth of from twelve to fifteen feet below the surface of the water from a tube contained within the hull of the vessel, second, it may be discharged from a launching tube mounted on the deck of a destroyer; and third, it may be discharged from the nose of a submarine.

It is the secrecy and invisibility of torpedo attack which invests it with such deadly moral and physical effect, and for this reason submarine torpedo attack is far more effective, both in its ability to get home upon the enemy and in its disconcerting effect upon the morale, than when it is delivered from a battleship or cruiser, or from the swift torpedo boat or destroyer. Broadly speaking, the torpedo tube fitted in the larger ships can be brought into use only in the later phases of a hard-fought engagement, when the enemy's gunfire has been silenced or greatly reduced, and his ships have been so badly cut up that they have lost their maneuvering power, and it is possible for the enemy to draw in within easy torpedo range. Destroyer attack will generally be carried out at night or in thick weather, or when the enemy's line has been broken up and his ships are more or less crippled and the rapid-fire batteries silenced. Attack by submarine, however, can be successfully carried out at any time of the day or night; and the records of the present war show how successful such attacks may be.

The object of all torpedo warfare is to detonate a heavy charge of high explosive against the submerged portion of the hull of a ship, and with such damage that the enemy will either be sent to the bottom or will be so seriously crippled as to be incapable of successful maneuvering. The ideally perfect means of attack would be a man-controlled submarine carrying an enormous charge of explosive in its nose, and possessed of sufficient speed to enable it to overtake the enemy and explode that charge unerringly at a carefully selected point on the hull of the ship, preferably abreast of the magazine. Attempts have been made to develop such a weapon; but thus far they have been defeated, first, by the impossibility of building a submarine of sufficient speed to accomplish this result; and second, by the fact that the detonation of such a large charge would mean the inevitable destruction of the submarine itself.

In the present state of the art the work of delivering the vital blow against the ship is entrusted to an automatic, self-controlled, miniature submarine, known as the torpedo. The place of the quartermaster or his equivalent, who in the submarine attends to the steering in the vertical and horizontal planes, is taken by a wonderfully ingenious and effective automatic steering mechanism, which, if it be properly adjusted, will carry the torpedo at an initial speed of 40 knots unerringly to the mark through a distance of from 7,000 to 10,000 yards. The British claim to have developed their own submarines to a point at which they will do accurate shooting at the last-named distance. Obviously, the chances of error are increased in proportion to the distance from the mark, and hence it is always the aim in torpedo attack to get as near as possible to the enemy before the torpedo is launched. It is in this respect, in addition to its invisibility, that the submarine is the beau-ideal torpedo vessel; and in the recent attack by German submarines, in which a single blow has been sufficient to send the enemy to the bottom, it is probable that the submarine crept up, unseen, so close to the victim that it was practically impossible to miss the mark.

We present three illustrations showing the external appearance, the internal mechanism, and the method of launching from a destroyer, of one of the latest submarines in existence; the type [illegible] and known as the 21-inch Bliss-Leavitt [illegible]. The torpedo consists, essentially, of a [illegible] of guncotton carried in the head, as [illegible] the illustrations, an air tank containing the motive power in the shape of a charge of [illegible] air, an engine for propulsion, and [illegible] total rudders for steering in the [illegible] tical planes, with automatic means for [illegible] rudders. With this general description [illegible] follow, in detail, the longitudinal sectio[illegible] very clearly interior construction of one [illegible] wonderful machines. The "war head" or nose of the automobile contains a guncotton charge of 250 pounds. Normally a safety pin *G* prevents the movement of a plunger or striking rod *A*. Before the automobile is loaded into its tube, the pin *G* is removed and the plunger, or trigger, is in position to strike and fire the detonating charge *D* which extends centrally through the guncotton charge. Immediately back of the guncotton is the air tank *B* filled with air at high pressure. A pipe leads through a reducing valve to the turbine engine, which through a shaft *S*, drives the two propellers *I, I*, in opposite directions.



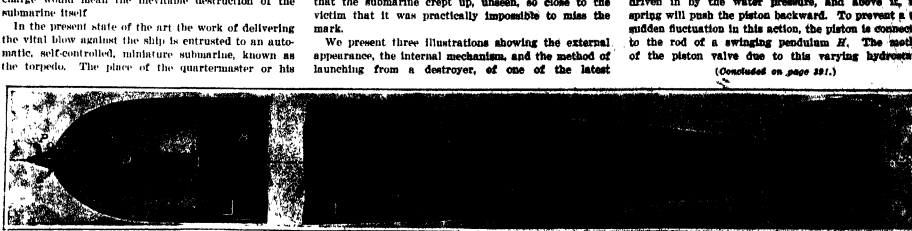
Discharge of a torpedo from a launching tube on the deck of a destroyer.

Note the air exhaust from the tail of the torpedo.

Immediately back of the air tank is what used to be known as the "secret chamber"; and for many a decade in the earlier history of the torpedo the secrets of this chamber were successfully concealed. It contains the mechanism for maintaining the torpedo at the desired depth of about fifteen feet below the surface of the water. This it does by controlling the horizontal rudders at the tail of the torpedo. Immediately at the back of the secret chamber is a narrow compartment perforated on its outside wall to allow the water to enter and exert a hydrostatic pressure due to the depth of the torpedo below the surface of the water.

The rear wall of the secret chamber carries a piston valve *K* which is capable of movement in the direction of the axis of the torpedo. The rear wall is watertight and flexible, and the pressure of the water upon it, tending to drive it inward, is resisted by coil springs, as shown at *K*. At a certain predetermined depth, according to the tension of the spring, the spring and the water pressure will be in equilibrium; below that depth the piston valve will be driven in by the water pressure, and above it, the spring will push the piston backward. To prevent a too sudden fluctuation in this action, the piston is connected to the rod of a swinging pendulum *H*. The reciprocating of the piston valve due to this varying hydrostatic

(Concluded on page 391.)



A longitudinal section through a Bliss-Leavitt torpedo, showing the disposition of the explosive, the driving machinery, and the propellers.

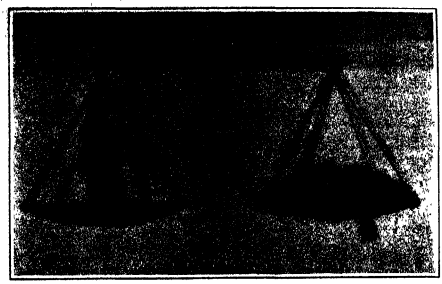
P, plunger or striking rod. *G*, safety-pin. *C*, guncotton charge. *D*, detonating charge. *B*, air-flask. *J*, charging valve. *K*, hydrostatic valve. *H*, pendulum. *M*, turning. *N*, governor. *E*, pressure regulator. *Y*, gyroscope. *T*, automatic impulse. *U*, servo-motor. *G, V*, rudders for horizontal control. *G, H*, rudders for vertical control. *P* and *G*, rudder controls. *S S*, propeller shaft. *I, I*, propellers. *R*, shaft bearings. *A*, after body. *L, B*, ballast.

THE INTERNAL MECHANISM OF THE LATEST TYPE OF TORPEDO

War the Destroyer

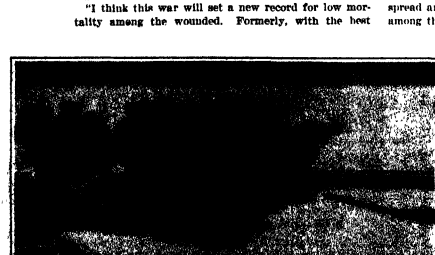
The Chances of Death in Battle and from Other Causes

By Alfred J. Lotka



The cost of killing. In the Russo-Japanese war 70 pounds of gold and 1,053 bullets were spent per man killed.

The paradox of the bad shot. The fire of poor marksmen may be more effective than that of sharpshooters.



The bacillus is mightier than the bullet. In the Crimean war, out of every sixteen men one died of wounds and four of disease.

To the mind of the untrained observer the very word chance conveys the notion of something beyond the pale of natural law; something which obeys no rule and defies all measure and reckoning. Diametrically opposed to this is the conception which the mathematician and the physicist has of chance. To him the very essence of chance events is that they obey definite laws. The statistics compiled by a life insurance company enable the actuarian to foretell with much precision the toll that death will exact in a year among the body of insured. It is said that large engineering firms of long experience can predict very closely the number of human lives that a given construction will cost. In war, too, laws of chance are operative, though here, we have not the same wealth of data based on actual observation from which to draw our conclusions, and furthermore, conditions are so widely different in different wars and may change so extensively in the interval between the successive wars, that predictions are necessarily uncertain. Of course, when the requisite data of a problem of chances in war are given, there is no difficulty in drawing the logical conclusions. As an example, consider an army of 250,000 men, who engage in battle with a loss of 50,000 killed and wounded. Suppose the gaps in the ranks to be refilled by re-inforcements, and the army, now once more 250,000 strong, to fight a second battle, and so on, the casualties being at each battle 50,000, which are made up by fresh troops before the next encounter. Suppose five such battles to be fought. What are the chances that a man in the original army of 250,000 shall fight through and survive all the five battles?

The answer is not hard to find. The chances of survival unhurt after the first battle are evidently 200,000/250,000, or 4/5.

In the second battle 200,000 men of the original army are fighting, and if we suppose casualties to be evenly divided among the original men and the fresh troops, then again ⅘ of the former, i. e., 160,000, will come out of the battle unhurt. Similarly, at the third battle ⅘ of 160,000, or 128,000, survive in condition to engage for a fourth time. Of these another ⅘, or 102,400, enter the fifth battle, and lastly 81,920 escape from injury in the fifth battle. There were in all 250,000 men in the original army, hence the chance that any one of them will survive five battles with the casualties and re-enforcements as indicated are 81,920 : 250,000, or 0.32768 : 1.

If the reader is mathematically inclined, he may amuse himself by proving that the probability of a given soldier of the original army being put out of action in n battles is

$$P = \frac{1}{5}\left\{1 + \frac{4}{5} + \left(\frac{4}{5}\right)^2 + \left(\frac{4}{5}\right)^3 + \ldots + \left(\frac{4}{5}\right)^n\right\}$$

$$= \frac{1}{5}\left\{\frac{1 - \left(\frac{4}{5}\right)^{n+1}}{1 - \frac{4}{5}}\right\} = 1 - \left(\frac{4}{5}\right)^{n+1}$$

One conclusion from this formula is, that it would take an infinite number of battles to put out of action all the men of the original army (i. e., to make the probability of a given one being killed or wounded equal to unity). This, of course, disregards deaths from disease or old age, which would have reaped in the last man long before the infinite series of battles had been fought out.

And disease is more to be feared in war than are bullet and shell. In the Crimean war, out of every one thousand of French troops 293 died by disease and only 94 from wounds. Among the English troops the corresponding figures were 176 and 47. Napoleon in the march to Moscow lost two thirds of his army, though he fought only one general engagement. The Russian armies operating against him lost, in the course of five months, four fifths of their strength. The losses of the Federal armies in the civil war in two years amounted to 359.5 deaths in the thousand, of which only 6.5 were caused by wounds, the remainder, 44.6, by sickness. In the Franco-Prussian war the losses of the Germans were 34.7 per thousand from wounds, and only 30 per thousand from sickness. This is explained partly by the shortness of the campaign (seven months) and partly by the fact that the Germans were greatly superior in numbers and were able to send their sick home. In the Russo-Japanese war the ratio of deaths by sickness to deaths from wounds was three to one among the Russians and two to one among the Japanese. As for the present war in Europe, Sir William Osler has made the following observations:

"I think this war will set a new record for low mortality among the wounded. Formerly, with the best first aid and hospital work, a mortality record of five or six per cent of those who reached the base hospitals was considered creditable. Up to date there has been but one fatality out of more than seven hundred wounded who have reached the base hospital at Oxford. This death was caused by tetanus.

"This result is partly due to the self-sterilization of the modern high velocity bullets and partly to efficient field first aid. I have yet to see a wound by either a dum-dum or an explosive bullet.

"If the experience of the past counts for anything, the expeditionary force on the Continent has more to fear from the bacilli of typhoid fever than from bullets or bayonets. In the Boer war bacilli accounted for 14,000 of the 22,000 lives lost.

"All fighting forces should take advantage of the knowledge that the human body can be protected from typhoid fever by vaccination. The success of this measure in the armies of the United States and France is proof enough. I do not fear that typhoid fever will break out in the camps in England, but this is not so in the large areas of the Continental theater of war.

"And then, with the coming of winter, the prevention of pneumonia will be a problem. It cannot be prevented like dysentery by the conscientious boiling of all the water drunk. Many people carry pneumonia germs with them, which are harmless as long as a soldier is in good condition, but which make their way to the lungs when the resisting powers of the body are lowered by exposure incident upon long marches and hard fighting in cold and rain."

The question is often discussed whether modern war is more deadly than the wars of the past. The supposition that the progress of modern military science is rendering war more and more deadly is contradicted by the fact that in the Franco-Prussian war 385 bullets were fired for every Frenchman killed, while in the Russo-Japanese war the corresponding figure was 1,053.

The fact is that progress in the art of killing is always surpassed by progress in the art of defense. "The result is," says Gen. Percin, "that the ratio of men killed or wounded in actual battle is continually diminishing. This ratio was 6 per cent under Frederick the Great, 3 per cent under Napoleon, 2 per cent in 1870 and ½ per cent in Manchuria."

The result of this increased efficiency of defense, is to increase the "cost of killing." Thus it has been estimated that in the Russo-Turkish War (1877-1878) the cost of one human life was $15,000; in the Russo-Japanese war it was $20,400. In the Franco-Prussian war the cost was exceptionally high, viz., $21,000. This is due to the small number of great battles.

Closely related to the subject of the cost of killing is that of the effectiveness of gun-fire. A group of shots fired at a target will spread in a more or less regular manner about the *center of impact*, which, if the fire-arm is correctly built and the range rightly estimated, should correspond to the point aimed at. The shots spread around this center owing to a number of causes, among them inequalities in the ammunition and errors of the gun. The principal cause of dispersion, however, is inaccuracy of aim on the part of the marksman. The appended table shows the dispersion of average shots at different ranges:

TABLE OF DISPERSION—AVERAGE SHOTS.

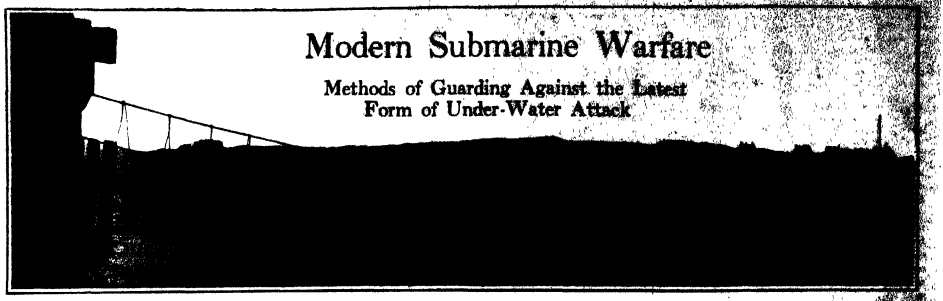
Range.	Mean		
	Vertical.	Lateral	Longitudinal
Yards	Feet.	Feet.	Yards.
100	1 07	0 97	3 98 04
200	2 03	1 77	398.21
300	2.87	2 41	348 79
400	3 59	2 90	282 04
500	4 21	3 26	219 91
600	4 88	3 75	185 37
700	5 62	4 40	156 66
800	6 44	5.23	135 28
900	7 33	6 21	118 57
1000	8 29	7 37	105 89
1500	14 50	11 98	76 00
2000	22 71	18 76	64 00

The phenomenon of dispersion gives rise

(Concluded on page 391.)

Modern Submarine Warfare

Methods of Guarding Against the Latest Form of Under-Water Attack



Defenses at entrance to a British harbor, consisting of pairs of heavy superimposed cables, looped together with lighter cables. Their object is to prevent the passage of submarines.

A STUDY of the history of naval and military attack and defense shows that every new means of attack has been met by a more or less effective form of defense. Thus, in the past half century of naval warfare, the ever-increasing power of the gun has been met by a fairly commensurate improvement in armor, the iron plating of the French ships in the Crimean war being followed, successively, by the compound plates of steel and iron, the homogeneous all steel plate, the Harveyized plate with its carbonized surface, and lastly, the gas-hardened Krupp plate with the various later improvements of the Krupp system. The Whitehead torpedo carried on the swift torpedo boat found its answer in the high-velocity rapid-fire rifle and in the more minute sub-division of the hull of the warship. Bomb-dropping from aeroplanes and airships has its answer in high-angle rifle fire and in the covering of the magazines and other vulnerable portions of the ship by screens of horizontal armor.

The latest, and in certain conditions of warfare, the most deadly means of attack, the submarine, still awaits an effective answer, as the recent successful exploits of the German submarine flotilla have most conclusively proved.

Submarine the Weapon of the Weaker Power.

Long before the present war, it had been recognized that the submarine was essentially the weapon of the weaker power, and therefore of what might be called the offensive-defense. Ten years ago, when the speed, range, and sea-keeping qualities of the submarine were very limited, it was considered that its rôle would be confined to harbor defense, and that, even in this restricted sphere, its value would be moral rather than material. That is to say, the dread of unseen attack would at once prevent a close blockade by the enemy and would have a wearing-down effect on the morale of the officers and men.

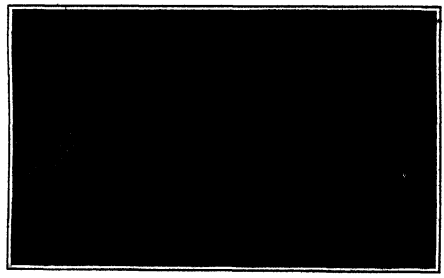
So rapid has been the development of the past decade, that the largest of the German submarines has a displacement of 800 tons, a surface speed of about 17 knots, a speed submerged of about 10 knots, and a theoretical radius of action on the surface of 3,000 to 3,500 miles. One of the United States submarines has remained submerged, with the crew aboard, for twenty-four hours; and, in the opinion of our submarine officers, it would be possible, by the use of chemical purification of the air and by drawing on the air supply of the submerging and trimming tanks, for one of our submarines to remain submerged for several days.

The living quarters of the largest vessels are sufficiently commodious for a fair degree of comfort, and the cooking, washing, and toilet refuse can be discharged in diluted form by force-pumps. The range of the submarine is limited not so much to the capacity of the fuel tanks as by the endurance of the crew. If the weather is fine and the submarine can proceed, undetected, at the surface, the cruise might extend to one or two thousand miles, without a return to port; in surface cruising in rough weather, the watch is continually drenched, and the lack of means to dry the clothing and other discomforts would render an earlier return to port a physical necessity.

The information which has come through regarding the naval operations in the North Sea, gives reason to believe that the German submarines, in their search for their quarry, have made cruises of several hundred miles; for, moreover, they have been reported as operating off the English and even the Scottish coasts. Their principal cruising ground, however, is off their own coasts, where they go out and lay in wait for the cruisers and destroyers which are steaming to and fro off the mouths of the Elbe, the Weser, and the Ems. A probable plan of operations is for a submarine flotilla to pass out at night to selected positions on the enemy's patrol routes, submerge and await the coming of the enemy. If the submarine is discovered, it can "go to sleep" on the bottom until the search for its whereabouts has been given up. It is reported that the loss of the three British cruisers of the "Cressy" class was brought about by the co-operation of a scouting Zeppelin with the submarine which made the attack.

Defense Against the Submarine.

So far, no single effective means of defense, such as that of armor against the gun and the gun against the destroyer, has been devised against the submarine. Protection must be sought in the co-operation of several precautions, which, in their aggregate effect, should afford, and doubtless are affording, a fair measure of security. Among these may be mentioned: Thorough sub-division of the hull; interior armor; a careful look-out from the ships and by aeroplane scouts; a high cruising speed and frequent changes of course; instant ramming by destroyers; and the rapid-fire gun. The above defenses are effective if the fleet is under way. If the fleet is at anchor in a roadstead or harbor, protection may be afforded against the submarine by mine-fields, heavy chain cable entanglements and netting.



This photograph shows a torpedo caught by its propeller in a battleship torpedo net.

Protection by Sub-division.

The best protection against the submarine, so far as the absolute loss of a ship is concerned, is a thorough system of sub-division. Large ships such as the "Cressy," "Hogue," and "Aboukir," which went down rapidly after being torpedoed, were of an older type, built at a date when sub-division, judged by present-day ideas, was comparatively limited. In later ships of the largest size, such as battleships and battle-cruisers, sub-division has been made so minute, that it is believed a ship of the type of our "Pennsylvania" could take the blows of two or even three torpedoes, without going to the bottom. The pre-dreadnoughts of the "Connecticut" class have over five hundred separate watertight compartments, big and little, below the protective deck.

Protection by Armor.

Of late years great attention has been given to the question of working into the hull a certain amount of longitudinal armor, for the purpose of meeting the force of the torpedo explosive on the outer skin, or of confining its effects to the outer portion of the ship, thus preserving intact the vitals. Thus, the flagship of the British fleet, the "Iron Duke," is generally credited with having thin armor extending below the main belt down to the bilges, this armor being applied externally. A more common method is to run a longitudinal belt of armor about two inches in thickness, along the inner side of the series of torpedo compartments, near the outer skin, with which all capital ships are provided. The main object of such armor is to protect the magazines, which, if they be reached by the shock and heat of the torpedo explosion, are liable to be set off and the ship instantly and absolutely destroyed. This effect is shown very dramatically on the colored cover of the present issue.

Protection by a Careful Lookout.

In calm weather it is surprising at what a distance the periscope of a submarine can be detected by a good look-out. In rough weather, however, it is difficult to make out even the wash of the periscope until the submarine is within point blank range. Experimental work done by our army aviators has proved that in clear and calm weather it is possible to detect a submarine even at a considerable depth, when the aviator flies at a height, say, of about 2,000 feet. In rough water it is more difficult so to detect the submarine, although, if it were running with its periscope exposed, a hydro-aeroplane searching around a ship that was steaming slowly on patrol duty would probably detect the approach of the enemy in time for the cruiser to make a change of course.

Had the "Cressy" and her two sisters each carried an aerial scout, the disaster, possibly, might have been prevented.

Protection by Ramming and the Rapid-fire Gun.

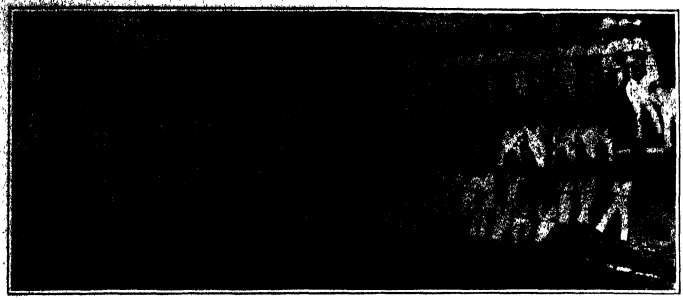
The tactics used when an attack is expected are for the scouts and destroyers to attempt to sink the submarine by putting on full speed and making a rush for its periscope in the hope of hitting that, or even the hull itself. If the submarine were ever so lightly touched by the sharp forefoot of a destroyer running at high speed, it would be ruptured and the vessel sunk; also if the periscope were struck and broken off or bent, there would probably be heavy leakage around the stuffing boxes, and disablement would follow.

We have heard a good deal during the war of the sinking of submarines by concentrated rapid fire from the torpedo-defense guns; but the periscope offers so small a mark, that we doubt if any vessel has been sunk in this way.

Protection by High Speed and Change of Course.

Although the surface speed of the latest submarines runs from 15 to 17 knots, this speed is not available during attack. A submarine must submerge, and in the submerged condition the speed is only from, say, seven to nine, or perhaps ten knots. The best protection, therefore, for a patrolling fleet, is never to let the speed drop below about fifteen knots; for where there is a difference of five knots in speed, the submarine's only chance of getting within range will come when it finds itself in or near the course of a hostile ship that is bearing down upon it. Hence, for self-protection, cruisers on patrol or scout duty should not only maintain a good rate of speed, but they should make a frequent change of course.

A great naval campaign, such as that which is being carried on between the British and German fleets, can be brought to a decisive conclusion only when the



View at bow of "Moltke" (sister to "Goeben"), showing crew seated on torpedo net, which is rolled up against side of ship.

...as we have already shown in previous issues, the German fleet, being greatly inferior in strength, has taken position in its various harbors and roadsteads, the entrance to which are blocked by mine-fields, by heavy booms, and by netting and cables. Behind this protection, the ships themselves are safeguarded by torpedo netting, which is boomed out from the vessel, and extends like a curtain for nearly the full depth of the hull.

Torpedo Booms and Netting.

We present several illustrations showing the methods by which a harbor with its contained fleet may be rendered secure against the insidious attacks of the submarines. No submarine of the standard type would attempt to pass through a mine-field, particularly if the mines were anchored at varying depths, as shown in our illustration. Contact with one or other of the mines, either by a direct blow or by becoming entangled in the cables, would be inevitable if an attempt were made to break through.

Simon Lake, it is true, worked out a method by which a submarine could move over the floor of a channel; and we note that the inventor has lately claimed that this device, as perfected in later submarines, will make it possible to move on the bottom, cut loose the mines, and so get into a harbor. That this has been worked out to a practical conclusion, however, we very much doubt. Should a submarine manage to get through the mine-field, however, it might find itself opposed by entanglements consisting of heavy steel netting, or of interlaced cables hung in the manner shown in our illustrations of an actual device of this kind, as installed in one of the British harbors.



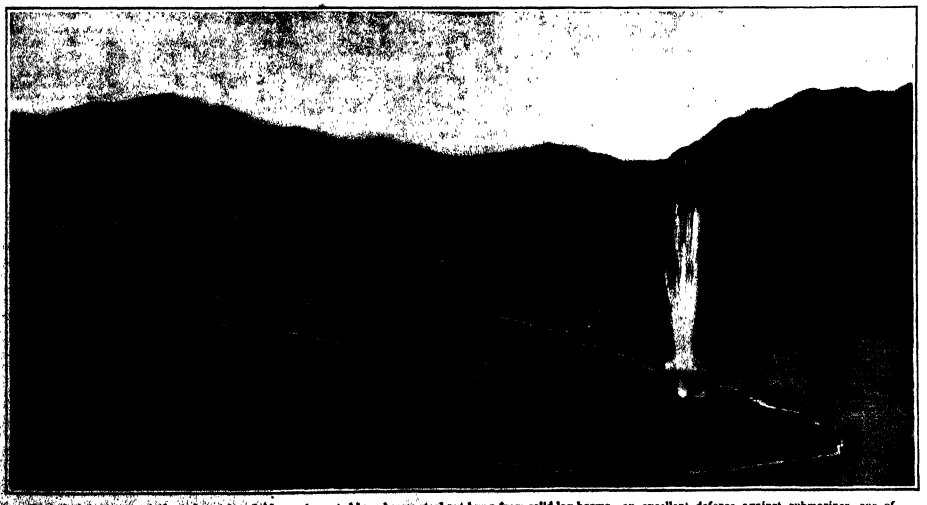
Torpedo net suspended by booms and wire cables from the side of a battleship.

War and Tuberculosis.—It is a well known fact that in every war the ravages of disease are far deadlier than those of rifles and machine guns. Typhus and typhoid, dysentery, diarrhœa, and cholera are among the most faithful followers and fatal foes of an army. But the danger of a great increase of tuberculosis in wartime has been hitherto overlooked. Dr J. Kollarits, writing in the *Vienna Clinical Weekly*, calls attention to this with grave words of warning. In many individuals, he maintains, there are latent germs of the great white plague which the organism is strong enough to resist in the ordinary conditions of life, but which will speedily develop under the hardships, exertions, excitement, anxiety, and exposure of warfare.

"These men will soon become ill, retire from the fighting line with 'catarrh of the lungs,' and frequently there will be a failure to comprehend what is at the basis of the apparently harmless symptoms. The poorest, who need fresh air as much as daily bread, will lie ill at home, in the dust of villages or behind the closed windows of hospitals in big cities, where their condition will naturally not improve. It would be more effective treatment to place our sick heroes amid green woods or on sunny mountains, and I believe this would not be so difficult of accomplishment as at first thought it may seem.

"By the beginning of September most of the summer resorts in the mountains are closed and remain empty until the next summer. It would be a remarkably patriotic deed if the directors of these enterprises would turn their empty buildings over to the Military Bureau of Sanitation for this purpose. Thorough disinfection later would leave the next summer's guests nothing to fear. Specially desirable would be those places where one large hotel remains open, with many smaller ones closed."

A Trade-mark Decision.—Mr. Commissioner Moore in *ex parte* The Gamewell Fire Alarm Telegraph Company has held that it is essential to registration of a trade-mark even under the ten-year clause that the mark shall have been used as a trade-mark. In the same case he held that the mere size of the mark does not make it non-registrable; nor does the fact that it is applied to the goods by being made integral therewith in the process of manufacture. Further in the same case he held that a trade-mark described as a figure consisting of straight sides and curved top and bottom formed of two parallel lines was not registrable on the ground that it was merely an ornamental feature on the door of a police-telegraph box, and that the record does not show that it ever was used as a trade-mark or was so regarded by the officers of the applicant company.



Harbor defense, consisting of a mine field supplemented by a heavy steel net hung from solid log booms—an excellent defense against submarines, one of which is shown in contact with a mine.

Strategic Moves of the War

Letter from the Military Correspondent of the Scientific American, October 31st, 1914

The Campaign in France.

THE Germans are still forcing the fighting in France, as is natural since any delay in the decision is to the advantages of the Allies. The total population of the two Germanic empires in Europe is about 116,500,000, while the European population of the five allied nations is 232,000,000, almost twice as great. But in this war every nation is calling on its colonies and on the resources of all the world. A truer comparison of the resources of the combatants is obtained by comparing their total population. On this basis, the 132,000,000 Germans are contending against 722,000,000 Allies.

Germany especially has gained the advantage in the first three months of war, due to her efficient military system of the last thirty years. Her annual expenditures for her army have been less than those of France and only about two thirds those of Russia; yet she was able to develop a strength that made it possible for her to force the fighting into hostile territory both in France and in Russia. Of all of the nations now engaged in the great war, Germany seems to be the only one that was fully prepared when the trouble came.

After the failure of the great raid to crush the French in August, the Germans apparently intended to turn their forces against Russia in an effort to strike a blow there that would break up the Russian plans. The unexpected development of force by the Allies on their northern flank in France and the active raids of the Belgian garrison of Antwerp so endangered the German right flank that the Russian invasion had to be postponed until the line in France could be sufficiently strengthened to hold safely. This resulted in the campaign for the capture of Antwerp and in the advance of the German line to the coast and to the Franco-Belgian border.

The German operations in France during the last week might well be described as vigorous defensive tactics. They wished to deliver a telling blow in Russia, but at the same time it was necessary to keep the French and British busy in the west. The Germans again used their tactics of concealing the weakening of their line by using the remaining troops to make assaults. At all points of the line they have been making demonstrations of reconnaissances in force. At most points these attacks were repulsed; at others the opponents were driven back a few miles. At some the counter-attacks drove the Germans back an equal amount. At most points the net result of the operations has been practically no change in relative strength of the positions occupied. The Germans seem, however, to have achieved their object of holding the Allies while delivering their blow in Poland.

The proximity to England and the presence of British troops causes us to get most news from the Belgian theater of operations. This, too, has been the scene of the turning effort by the Allies and of the German counter-move against Dunkirk. While the contest seems to be settling down to a drawn battle on this flank, as in the center, there is still a chance for one side or the other to break through.

The advance to the Belgian coast and the occupation of Ostend gave the Germans a harbor of refuge for their submarines, two hundred and fifty miles nearer the Strait of Dover than their home port at Emden. They promptly took advantage of this and their submarines have already appeared in the fighting on the Belgian coast.

The advantage to the Germans of the capture of Dunkirk will be similar. It will give them a much better harbor and will bring their submarine base still closer to the British transport service in the English Channel. There is little probability of any aerial or naval raid against England from the channel ports if they should be captured, but in the contemplation of this imaginative use their value to the Germans has been overlooked. The great British base of operations on the Continent is at Le Havre. For the supply and reinforcement of her troops near the coast, though, she uses the shorter line through Dunkirk, Calais, and Boulogne. A further German advance would interrupt this last service and would handicap the British forces to some extent. Still more important, it would give the Germans a harbor of refuge close to the lines of mines by which the British have attempted to close the strait. By carefully working their way through the mine-field, the German submarines could reach the English Channel and could attack the British transports. The sinking of a number of ships loaded with troops might force Great Britain to abandon the shipment of troops and supplies to France until the danger could be removed. So great is the expenditure of life as well as of ammunition, in fighting on the scale of that in France, that any interruption in the forwarding service would soon cripple the operations at the front.

The first German attempt was made by rushing troops northwest from Lille toward Calais in an effort to cut in behind the forces of the Allies on their extreme northern flank. The rebound of this move carried the Germans back and resulted in a ten-mile advance by the Allies to Roulers, east of Ypres.

The German efforts are now being directed along a different line. By driving against the Belgians close to the coast they hope to break through to a position where they can threaten the rear of the opposing troops farther south.

The crossing of the Yser is the first step in this move. Much hard fighting will be necessary, however, before the attack can be carried further. The attacks at La Bassée, Lens, and Arras are parts of the same campaign, being, apparently, demonstrations to divert attention from the region selected for the main blow.

In the rest of the battle-line, from Arras to Verdun, the attacks and counter-attacks have nowhere changed the positions as much as five miles. The advantage in the small modifications of positions seems to lie slightly with the French.

There has been some very stubborn fighting, however, east of St. Mihiel, which is on the Meuse River half way between Verdun and Toul. Here the Germans have maintained their salient position under conditions that would ordinarily dictate a retreat. The presence of the heavy siege guns close to their front have prevented successful frontal attacks by the French, who have, accordingly, attempted to force the German retirement by pushing forward a strong army to threaten their rear. This French army advanced from Toul and Nancy and has now reached a position running eastward from the outskirts of St. Mihiel, through Apremont and Thiaucourt to Pagny, on the Moselle, twelve miles south of Metz. At the same time the French have pushed forward to the north of St. Mihiel until they have cut down to seven miles the strip by which the advanced German forces maintain connections with their main body. The position at St. Mihiel is apparently being held at great cost on account of its importance for some future move of the Germans. The latter are making desperate efforts to hold on, while the French are equally determined to make them loosen their grip on the Meuse fortifications.

The Russian Campaign.

In this campaign the fighting is as yet more open than that in France. The moves cover more ground and the advantages are correspondingly more obvious. The maneuvering of the troops has greater influence on the outcome than in the hammering process in the west, and the increased action adds to the interest.

The meagerness of the news is all the more to be regretted. The definite moves of the troops have to be gleaned from conflicting statements or determined from the necessary consequences of the announced movements.

The general campaign in this field also has, until the last few days, been one of aggressive action by the Germans. This has carried the fighting half way across Poland and has visited upon the hostile territory the ravages and the hardships of war.

The strategic dash from Silesia to the Vistula brought immediate results in the rapid retreat of the Russians from Tarnow and from Hungary, and in the weakening of their attacks in the north on Lyck, in East Prussia. The German force that made this advance in Poland was estimated at 800,000 men, yet they upset the plans of all of the Russian forces from East Prussia to Hungary, a total of over 2,600,000 men.

In the rapid march to the Vistula River, the German armies seem to have overstrained their supply service, particularly so on account of the unexpected rainy weather that made most of the roads impassable for automobile trucks. At the same time the Russians fell back steadily and drew in their forces from every direction. When the Germans and Austrians were fully engaged along the Vistula and the San rivers, from Warsaw to Stryi in Galicia, the Russians started south on October 13th with an army of cavalry and artillery that they had assembled under the protection of the fortress of Novo-Georgievsk.

The German left flank fell back to the line through Blonie and Piasesno, where they attempted, on October 17th and 18th, to stop the Russian turning movement. The threatening advance against their rear of Cossack divisions from Sochaczew, forty miles due west of Warsaw, soon forced the Germans to beat a hasty retreat. This left their northern flank unguarded, and on October 20th forced them to abandon their entrenched position along the Vistula between Warsaw and the Pilica River.

The further pressing of the Russian turning move forced the Germans back to Skierniewice, forty-one miles southwest of Warsaw, and caused them to call up troops from the south to help hold their flank. This gave the Russians their chance and, advancing from Ivangorod, they drove back the southern portion of the line of their opponents.

On October 23rd and 24th the Germans had made a stand at Lowicz and Rawa, but were forced back toward Tomaszow by the Russian attacks. At the same time the line opposite Ivangorod has withdrawn beyond Radom.

The German plan of operations for the great battle included attacks all along the front while the Austrian army from Hungary turned the Russian flank on the south. This army performed its function in a close pursuit of the Russian columns and gained minor successes in rear-guard actions. When the Russians had drawn in their forces to Sambor and Stryi, they felt strong enough to make a stand. On this line and along the San River both the Austrians and the Russians claim successes, but no great change in relative positions seems to have occurred.

The advantage in the present fighting lies with the Russians, due partly to their strategic move against the German flank, and partly to the action of the elements in tying up the German transport service. The whole campaign is by no means decided yet, and the Germans and Austrians still retain the greater part of the advantages gained by them during the early part of October. The Germans still hold nearly half of Poland, while the Russians can claim a gain, in that they have checked one stage of the German plan of using their central position to deliver powerful blows in turn to the east and to the west.

The International Red Cross

IT is a singular coincidence that the eve of one of the greatest battles of modern times was also the fiftieth anniversary of the signing of the Geneva Convention which inaugurated the International Red Cross movement. For it was on August 22nd, 1864, that there was terminated the conference whose object was "the relief of the Wounded of the armies in the field." It was Henry Durant in his "Souvenir de Solferino" who first suggested the idea of creating in times of war auxiliary societies for the relief of the wounded. At the call of the Society of Public Utility of Geneva an international conference met in that city in October, 1863, and formulated a set of resolutions which established that wonderful humanitarian movement which forms the bright background in the dark picture of modern warfare. In order that these resolutions might have the force of a treaty a diplomatic conference met in Geneva at the request of the Swiss National Council under the patronage of Napoleon III. The representatives of twelve nations signed the famous pact which has since been known as the Geneva Convention. Too well known to need repetition is the story of the remarkable growth of the Red Cross movement which received its official impetus on that day—the movement which has enlisted the co-operation of every nation of the globe, and which has extended its sphere of usefulness beyond the battlefields of war to scenes of famine, of pestilence, and of industrial disaster. It may be of interest to Americans to know that the Geneva Convention was signed in the hall which was later named the "Hall of the Alabama" after the court of arbitration which met to settle the *Alabama* claims which had been a bone of contention between Great Britain and the United States. France was the first nation to become a signatory to the Geneva Convention, and although the United States had taken part in the original conference, it did not ratify the action of its representatives until 1882. The last nation to fall in line was Ecuador in 1907. In the meantime the articles of the Convention of 1864 were superseded by those of the Convention of 1906, of which the United States had the honor of being the first signatory. Apart from participation in the International Red Cross, the different nations have established their own National Red Cross organizations, the first of which was founded in Würtemberg in 1863. The American organization was born in 1866. The world-wide efficiency of the latter needs little comment. Of the contributions made to the Red Cross funds for the relief of the wounded of the five nations that took part in the Balkan Wars of 1912, the largest sum of money came from the United States.—*Medical Record.*

A Hot Wave in Egypt

A PERIOD of remarkable heat occurred in Egypt May 29th-June 2nd, 1914. At Helwan there was a maximum temperature of 122 deg. Fahr., or the hottest recorded at that place since the institution of observations in 1904. While this was the maximum for Egypt proper, higher readings were recorded in Nubian stations, the maximum being 124.4 at Kosseir, Red Sea.

The Naval Losses of the War

Analysis of the Methods of Attack of the Opposing Fleets and Their Results

A STUDY of the accompanying tables, showing lists of the ships which have been lost by the contending navies of Great Britain and Germany, proves how accurate was the forecast of naval experts as to the nature of the strategy and tactics of the opposing powers in the event of a great naval war between England and Germany.

Look at the column in these tables which is headed "How Lost"; and it will be seen at once that the damage inflicted by the Germans has been wrought almost entirely under the surface of the sea, whereas the losses inflicted by the British have been achieved almost entirely above water—in other words, the Germans have achieved their successes with the mine and the torpedo and the British with the gun.

It has always been contended that the submarine, and to a less degree the mine, was the weapon of the weaker power, and therefore presumably of the defense. The events of the present naval campaign have proved the truth of this supposition to an absolute demonstration.

That the Germans have accomplished so much with the mine and the submarine does not mean that the British are not experts with these weapons. Germany, being on the defensive, with her ships closely blockaded in her own ports and waters and protected by mine fields, booms, cables, and netting, it follows that her ships, except for the few which occasionally venture out for a reconnaissance, are inaccessible to the submarines and the floating mine. British submarines which have ventured into the mouths of the Elbe, the Weser and the Ems, have found the capital ships of the Germans absolutely protected against submarine attack—and this is as it should be. Germany is holding her ships of the line for that future day (which she hopes may come) when the depredations of her submarines and the accidents of the sea shall have so far worn down the numerical superiority of the British fighting line, that she may venture out for a battleship engagement with at least a fighting chance of success.

In looking at the list of British successes, it will be noted that they have been won almost entirely by the "man behind the gun." It has been believed by our naval officers that when they were put to the test of war, both the guns and the gunners of the British navy would prove to be first-class in quality; and certainly a study of the list of German losses would indicate that this confidence was well placed.

Whether the inability of the German gunners to hold their own against the British has been due to the lighter weight of their batteries, or to lack of skill in gunnery, or to both, can only be definitely known after the war, when its results come to be critically analyzed by the naval expert. For many years the SCIENTIFIC AMERICAN has drawn attention to the fact that the Germans were possibly making a mistake in arming their ships, big and little, with guns of lighter caliber than those of their possible opponents. The 4-inch guns of the "Mainz" were no match for the 6-inch and 4-inch guns of the "Aretbusa", and this raises the question whether the 11-inch guns which form the principal armament of the battleship fleet of Germany will not be similarly overwhelmed on the day of battle by the 12-inch, 13.5-inch and 15-inch guns against which they will be opposed, should a great fleet action ever take place in the North Sea



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An Austrian 12-inch howitzer in transit.

Official dispatches have stated that Austria has sent several of her 12-inch siege howitzers to Belgium and France Here we see the tractor with the gun detachment, the turntable and sleeve and recoil cylinders, and the gun barrel, each separately mounted for transit.



Mired to the axles in a wheatfield.

German and Austrian heavy siege artillery gets into difficulties when it leaves the macadam highway for plowed fields

NAVAL VESSELS LOST BY THE BRITISH AND JAPANESE NAVIES

NAME OF SHIP	TYPE	Date	Displacement	Speed Knots	Main Battery	HOW LOST
Cressy	Armoured Cruiser	1901	12,000	19.5	2 9.2-in 12-6-in	Submarine
Aboukir	Armoured Cruiser	1902	12,000	18.5	do	Submarine
Hogue	Armoured Cruiser	1902	12,000	18.5	do	Submarine
Hawke	Protected Cruiser	1891	7,350	19.5	2–9.2-in 10–6-in	Submarine
Amphion	Scout Cruiser	1913	3,440	27	10–4-in	Mine
Pathfinder	Protected Cruiser	1904	2,940	25½	8–4-in	Mine or Submarine.
Speedy	Gunboat	1903	810	18	2–4 7-in	Mine
Takachiho	Protected Cruiser	1885	3,700	18.5	8–6-in	Torpedo
Not known	Submarine					
Pegasus	Protected Cruiser	1897	2,140	21.0	8–4-in	Disabled by gun-fire

NAVAL VESSELS LOST BY THE GERMAN NAVY.

NAME OF SHIP	TYPE	Date	Displacement	Speed Knots	Main Battery	HOW LOST
Goeben	Battle-Cruiser	1912	23,000	28	10–11-in	Fled to Turkey
Breslau	Scout Cruiser	1912	4,550	28	12–4-in.	Fled to Turkey
Magdeburg	Scout Cruiser	1912	4,550	28	12–4-in	Aground blown up
Mainz	Scout Cruiser	1909	4,350	27½	12–4-in.	Sunk by gun-fire
Köln	Scout Cruiser	1910	4,350	28½	12–4-in	Sunk by gun-fire
Ariadne	Protected Cruiser	1901	2,660	21½	10–4-in	Sunk by gun-fire
Hela	Protected Cruiser	1895	2,040	18	4–3 4-in	Sunk by submarine.
Kronprinz Luise	Mine-layer	1913	1,800	20		Sunk by gun-fire
A–118	Destroyer	1902	420	28	3–18" tubes	Sunk by gun-fire.
A–117	Destroyer	do	do	do	do	do
S–118	Destroyer	do	do	do	do	do
S–119	Destroyer	do	do	do	do	do
V–186	Destroyer	1911	650	32.5	do	do
V–187	Destroyer	do	do	do	do	do
S–90	Destroyer	1900	400	30½	do	do
Not known	Submarine					Sunk by submarine.
S. M. der Grosse	Auxiliary Cruiser	1909	21,000	23	10–4-in	Rammed by destroyer
Cap Trafalgar	Auxiliary Cruiser	1913	26,000	18	8–4-in	Sunk by gun-fire

A Giant Rubber Tree

THE *Bulletin* of the Belgian Society for Colonial Research announces the discovery of an immense rubber tree in the borderland of Bolivia. It measures 8.25 meters in circumference at the base (about 27 feet) and the daily yield of caoutchouc for 120 days in the year is 10 kilogrammes. It belongs to a family of seven persons, and constitutes their entire support, which ought to be a very comfortable one, since *La Revue* (Paris) estimates from this yield that at the present value of rubber the tree represents a capital in round numbers of 300,000 francs ($60,000).

Bonding Asphalt to Concrete

THE necessity frequently arises in engineering works for joining concrete work with asphalt, especially in reservoir construction, but in this considerable difficulty has been experienced. Recently a new method has been tried in San Francisco, where the concrete surface was first painted with coal tar, and it was found that when applied in this way under right conditions the asphalt would adhere so firmly that after it had cooled it could not be broken away without bringing pieces of concrete with it. In order to secure this result the concrete surface was first scrubbed clean with a bristle brush, and over this a thin coating of hot coal tar was "painted." The coal tar should be heated in small quantities, brought just to the boiling point, and then applied immediately. Heating the coal tar in large quantities, which necessitates some delay before it could all be used, did not give such good results, and the men were therefore instructed to heat more at a time than they could apply before it began to boil. The asphalt was placed over the coated surface in the usual manner.

Women Explorers in Siberia

AN interesting expedition is being sent out by the universities of Oxford and Moscow under the leadership of Miss M A. Czaplicka, who holds a traveling scholarship of Somerville College, Oxford, to study the tribes of the Yenesei region, in northern Siberia. The rest of the party are H A Hull of the University of Pennsylvania, in charge of physical anthropological work, Miss Haviland, zoologist and ornithologist; and Miss Curtis, photographer The expedition will spend a year in investigating the Tungus and Ostiaks, concerning whose customs and religious beliefs several points still remain unsettled

NAVAL SHIPS, OF AN AGGREGATE DISPLACEMENT OF 54,500 TONS, THAT HAVE BEEN LOST TO THE BRITISH AND JAPANESE NAVIES IN THE PRESENT WAR

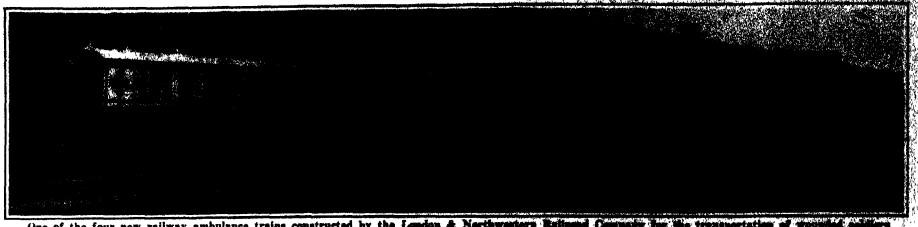
NAVAL SHIPS, OF AN AGGREGATE DISPLACEMENT OF 97,689 TONS, THAT HAVE BEEN LOST TO THE GERMAN NAVY IN THE WORLD WAR

NOTE.—The "Goeben" and "Breslau" fled to the Dardanelles and have been sold to Turkey.

Medical Science in the Service of War

Wonderful Improvements in Methods of Saving Life

By Charles Bolduan, M.D.



One of the four new railway ambulance trains constructed by the London & Northwestern Railroad Company for the transportation of wounded soldiers in England.

The vehicles were taken from mainline traffic and altered for hospital use in thirty hours.

IN all the pages of war news with which the daily press is flooded, perhaps no greater tribute could be found to modern medical science than the following dispatch:

"A correspondent in Ostend says that among the French wounded in recent fighting was a dragoon with six bullet and three bayonet wounds in the upper part of his body. He was expected to recover."

In the Franco-Prussian war a man similarly wounded would not have had a chance for recovery, that is, not if he had been taken to a military hospital.

When men are called to war, a great deal is said about the glory of fighting for the country and dying on the field of battle. Very little mention is made of the illnesses which befall the soldier who goes through the battles unscathed or his comrade who is wounded on the field. According to a statement made by a member of the Health Department of the French Ministry of War, "of every hundred men placed *hors de combat*, only two are killed." The problem of caring for the sick and wounded is therefore of the utmost gravity. But right here the inconsistencies of war are obvious. Each country maintains Red Cross workers whose duty it is to care for the wounded of the enemy as well as for the men who come by their wounds in the defense of their flag. These men and women, while engaged in aiding the victims of warfare, are still in the position of praying for victory for their army. And victory for their army means what? The slaughter and maiming of the enemy.

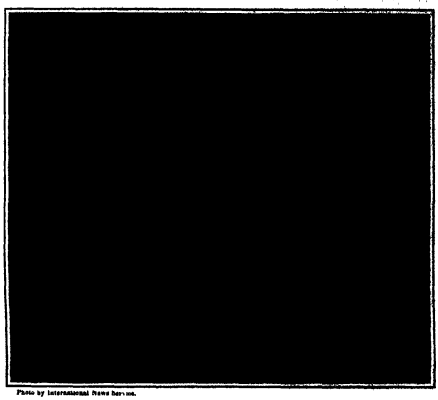


Photo by International News Service.

Major Richardson of the British army and two of the famous hounds that he has trained for Red Cross work on the battlefield. Major Richardson is well known for having introduced the dog into the police service.

Infection a Matter of Course.

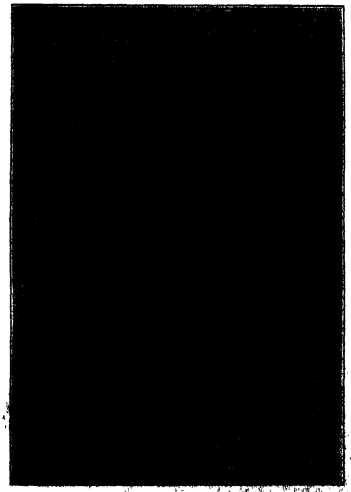
In the Franco-Prussian war the surgeons looked upon the infection of wounds as a matter of course. They regarded the presence of the attendant pus as a necessity, and as long as the pus was what was known as "laudable" they were satisfied with the condition of the patient. Other patients developed another form of pus, streptococcal, which caused the doctors of those days gravely to shake their heads and prepare for the death of the patient. Even the best hospitals were not properly ventilated and were filled with the foul odors emanating from infected wounds and gangrene. All this was considered unavoidable. At that time suppuration and kindred complications in wounded men were regarded as of spontaneous origin, although the researches of Pasteur had already pointed the way to a general understanding of germs. When, at length, purulent infection was found to be the result of germs, disinfectants were brought into use. Carbolic acid was the agent generally employed at first for that purpose, and the attendant success in

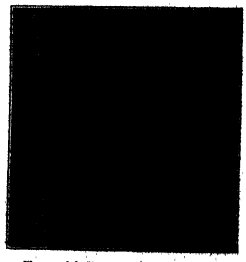


Effect of shot through second and third fingers.



Bullet lodged in left hand.





Shrapnel bullet embedded in the bone of the upper jaw.

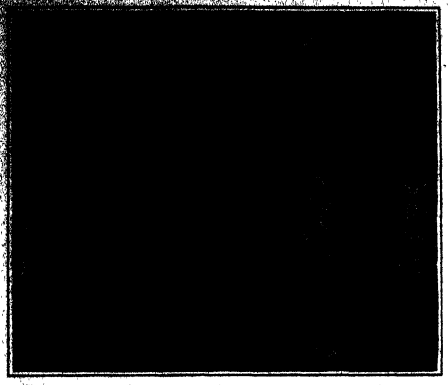


Fragmented rifle bullet in muscles of the neck. Only danger of infection.



Shrapnel bullet in thigh bone. Shattering and festering of the joint itself are apparent.

Shrapnel bullet in lower jaw. Liable to simple infection.



The ward cars of the British ambulance trains were converted from open freight cars.

They were reflored, and hooks were fixed in the ceilings for suspending folding cots in two tiers on both sides.



View down the center of ward car of a military ambulance train showing fixed berths and cots.

In the center of each train is a pharmacy car with treatment room, office, and all necessary supplies

treating surgical injuries and in performing operations where carbolised dressings were used and the air was subjected to a carbolic acid spray, caused the most profound amazement.

During the Franco-Prussian war 138,871 wounded died in the hospitals, while uninjured sick dying in the hospitals numbered 336,000. Many of these soldiers, if they recovered sufficiently to leave the hospital, were wrecks for the remainder of their lives. In contrast to the hospital treatment in the Franco-Prussian war let us glance at the Russian-Japanese war. In the great military hospital of the Japanese at Hiroshima there occurred but thirty-four deaths among 9,862 wounded. At first glance this low mortality might be attributed to the fact that the Japanese soldiers as a whole maintained such a high physical standard. But when the fact is considered that this hospital also cared for large numbers of Russian patients, and the death rate among them was approximately as low as it was among the Japanese, the credit must be given to advanced medical science.

A Lesson in Personal Hygiene.

The Russian-Japanese war taught a valuable lesson in personal hygiene. The habit of extreme personal cleanliness among the Japanese was an important factor in maintaining the health and resistance of Japan's troops. The Japanese troops kept their bodies clean by frequent bathing, and their rule of never going into battle without putting on clean underwear greatly reduced the danger of infection from wounds. The Japanese rations also had much to do with keeping the men in good condition. These generally consisted of some rice, compressed fish, army biscuit, salted plums, and a juicy pickle all neatly packed in a small tin box and wrapped in a towel. The Russian was fed on soup frequently made from questionable meat, and this has been held responsible for the large proportion of intestinal disorders on the Russian side.

While to-day the war machinery is more deadly, the number of killed and wounded in percentages remains about the same. The small steel-jacketed bullet used in rifle fire makes a clean wound, which rarely becomes infected unless a piece of cloth is carried into the wound with it. In the British army it has been found that bullets will pass through khaki linen, making a clean slit, and will not carry any particles of cloth into the wound. In the case of wool, such as Highland kilts or heavy flannel shirts, bits of wool are frequently introduced into the wound, and when this occurs, suppuration invariably follows.

First Aid Field Kits.

The use of the first aid field kit is of great importance. During the Boer war the British army carried field kits which contained a piece of gauze, a pad of flax charpie between layers of gauze, a gauze bandage four and a half yards long, a piece of mackintosh waterproof, and two safety pins, all of which was carefully packed in an air-tight cover. Another thing which the British found very desirable for field use was a paste for immediate antiseptic dressing on the field of battle. This paste was made up of mercury and zinc cyanide, tragacanth in powder, carbolic acid, and sterilized water. This paste was contained in a collapsible tube, and was particularly satisfactory in that form as it could be carried easily, and, when spread over a wound, would remain in place no matter what position the wounded man assumed. When the wounded arrived at the field hospital the surface surrounding the wound was cleansed with a solution of bichloride of mercury 1 in 1,000, or a two and a half per cent solution of carbolic acid. The wound itself was then cleansed and dressed with double cyanide of mercury and zinc which was covered with a pad of wool and a bandage.

To-day if a soldier is so wounded that an amputation is necessary he knows that he can usually undergo the operation with the chances in his favor. In the Franco-Prussian war, even with the aid of anaesthetics, only forty out of a hundred men who underwent amputations lived to tell the tale. The knowledge of aseptic surgery which army surgeons possess to-day permits of a patient coming through an amputation with a minimum amount of danger.

It is generally conceded that in the case of bullet wounds where the bullet is retained an operation should be avoided. Unless the bullet is directly under the skin or in such a position that the patient's life is in imminent danger, it is best to allow the bullet to remain. The modern rifle bullet is unlikely to cause infection, and frequently may be carried in the body without causing either danger or pain, while the results from an operation, performed in a field hospital, in more or less haste, may be questionable.

Disease More Dangerous Than Bullets.

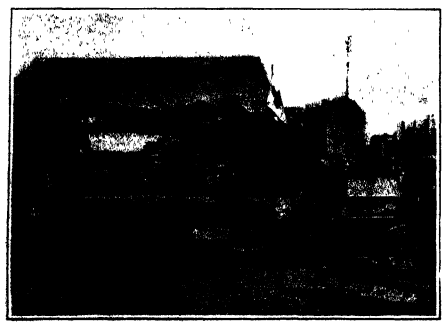
The fire of the enemy is by no means the only risk to which the soldier is subjected. Where large bodies of men are gathered into small quarters there is always the danger of disease. Before anti-typhoid vaccination was introduced typhoid fever rivaled the enemy's fire in the terrible toll it took among soldiers. In the Franco-Prussian war in the year 1870 there were 73,000 cases of typhoid fever in the German army. Out of this number there were 7,000 deaths. In the Boer war the British army suffered from typhoid fever to the extent of 57,000 cases, of which 8,000 died During the war with Spain the United States Army was ravaged with typhoid fever. In 1898 there were 20,738 cases and 1,580 deaths among 108,000 men In other words, one man in every five contracted typhoid fever. Even among the troops which never left the United States, but remained in the various concentration camps at home, one man in every six came down with the disease. In 1898 nine tenths of the deaths which occurred among the troops in the United States were caused by typhoid fever.

Typhoid fever is a preventable disease, particularly in armies. There are two ways in which it may be

(Concluded on page 394.)



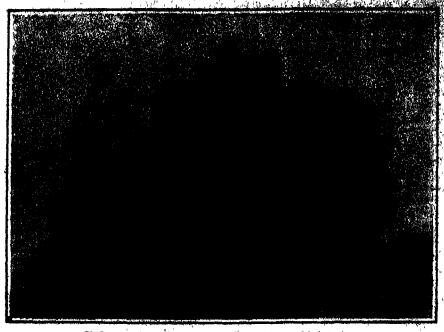
[illegible] Red Cross nurses and ambulance men carrying a wounded Belgian soldier into the hospital at Wilhelmsdorf, near Malines.



A motor truck used by the Germans as an ambulance. The wounded lie in two tiers upon stretchers.



Mercedes armored car used by the German army.



Italian armored car of the Isotta Fraschini type.

Armored Automobiles in War

Construction of Modern Battle Cars

By John J. Ide

AS was to be expected, reports from the various seats of war tell us of the widespread use of armored automobiles. Most of the nations involved have made exhaustive experiments to determine the most suitable of the types which range all the way from ordinary touring cars the sides of which are covered with steel plates, to huge moving forts. The most satisfactory cars have, naturally, proved to be those between the two extremes.

The service required dictates to a large extent the design of the car. In the early days of the war, the Germans made great use of standard N. A. G and Opel touring cars, to the sides of which are fastened steel plates of 4 millimeters thickness. No guns are mounted on the cars, the occupants being armed simply with rifles. Owing to the comparatively slight increase in weight over ordinary touring trim, these cars possess mobility of a high order and are well suited for scouting. They generally carry on each side of the dash a vertical rod having a knife-edge in front. The object of this is to sever any wires which may be stretched across the road, generally at the height of the pilot's head.

Much heavier armored vehicles have also been made use of by the Germans. These are generally trucks on which are maintained 5- or 7-centimeter Krupp or Erhardt guns. The armor plating is very heavy, being about one half inch in thickness. The rear wheels have twin solid tires and the front disk wheels have single tires of the same type.

The Belgians possess few, if any, heavily armored automobiles. They pin their faith to lightly armored, highly mobile cars, which have proved highly successful. Their speed and ease of manipulation enable them to rush to the desired spot, make a sharp attack, and, if necessary, retire quickly.

The detail illustrations show an ordinary touring car fitted with armor plating and carrying a quick-firing gun. Except for the gun, it is almost a replica of the German machines of the corresponding type. The steel plates are fitted to the interior of the body panels and project about twenty inches above the sides. The steel windshield with a hole for the driver to see through will be noticed. An interesting point is the guard on the driver's right to protect him when manipulating the levers, which happen to be mounted outside the body, thus rendering impossible the same protection as elsewhere.

A number of well designed cars armed with quick-firers were recently turned out by the Minerva Works, unfortunately destroyed during the bombardment of Antwerp. The armor throughout is of 5 millimeters compressed steel. A few cars were tried with armor plating ¼ inch thick, but they were found too heavy to give the same service as the more lightly armored chassis of similar power.

The radiator is protected by steel flaps which can be hooked in a semi-closed position, allowing sufficient cooling for ordinary purposes. Air circulation around the engine is assisted by an outlet on top of the hood. The twin tires on the rear wheels are a good feature quite apart from their great weight-carrying capacity, as they might enable the car to escape from a dangerous position in case a lucky rifle shot punctured one of them. The steel plate fixed behind the rear tires protects them to some extent. The efficient front wheel mudguards and position of the headlight will be observed. These cars are equipped with Knight engines of 26 and 28 horse-power.

The last word in Belgian armored car design is represented in the photograph of the S. A. V. A. The gun is mounted in a hemispherical revolving turret. These cupola-topped cars have two defects. One is, that there not being quite sufficient ventilation, the cupola gets filled almost to suffocation with gas; the other is that the ejected cartridge cases often strike against the back of the turret, ricochet back and hit the marksman in the head. Better protection to the occupants, however, helps to offset these drawbacks. The increased weight due to the roof certainly seems to demand greater tire support than is here provided. From the number of headlights fitted one would hazard a guess that the car was especially designed for night work.

So far, little has been heard of French armored cars in the war. It is known, however, that the authorities possess a number of "traveling forts" manufactured by Charron (formerly Charron, Giradot et Voigt), and Schneider of Le Creusot.

The Charron machine consists in principle of a closed car of armor plate provided with a machine gun mounted in a rotating turret. Running around the outside of the turret is a flange that rests upon the edge of the circular aperture in the roof. Referring to the sectional drawing, a rubber ring *A* is fitted under the flange to prevent movement of the turret during firing. The cupola is mounted on a central shaft supported from the frame of the car. The shaft is in two sections, the adjacent extremities of which are united by a nut provided with the hand wheel *B*. Rotation of the hand wheel causes the turret to rise and fall slightly. At its lowest point it is pressed down on the

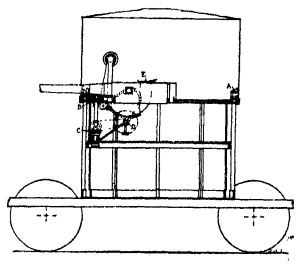
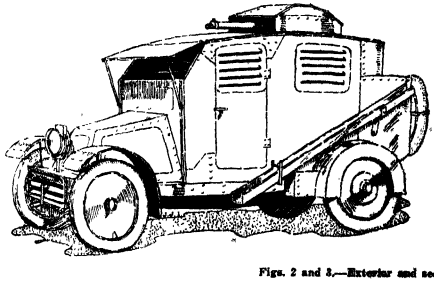
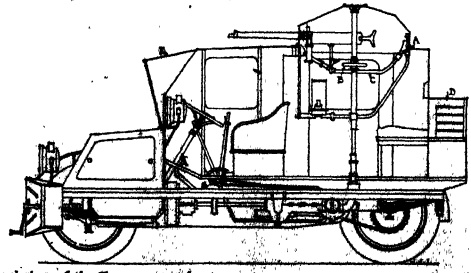


Fig. 1.—Sectional view of Schneider armored car.

A, rollers for revolving turret. *B*, gear wheel for actuating turret. *C*, bevel gearing through which pedal-driven spindle *D* is made to drive gears *B*. *E*, seat for gunner.





Figs. 2 and 3.—Exterior and sectional views of the Charron armored car.

A, rubber ring for clamping turret when firing. *B*, handwheel for elevating or depressing cupola. *C*, cross-bar on which gun is mounted. *D*, ammunition chamber. *E*, shield.

When it is desired to use the machine for service, the hand wheel is pushed forward, thus moving the cupola rapidly and allowing it to be rotated to the required direction. The machine gun is mounted upon the transverse bar, which is actuated by gear. The handle for operating *D* is at the right, and when in a normal operating position, inclined from again to downward, as seen from the car, hence as this machine is, the tires are pneumatic. In front of the driver is a hinged shield *E* which can be opened to any desired degree or completely closed, if desired.

The radiator, carried in a low position forward, is protected by steel plates with louvres arranged to admit a modicum of air. The machine is provided with two lamps, one mounted on the radiator, and another carried on a bracket behind the dashboard, in which is cut an aperture provided with a shutter, so that signaling can be indulged in. On each side of the vehicle just over the rear wheel is placed a girder, used to bridge over ditches, etc.

The Schneider armored car in general appearance is not dissimilar to the Charron. A special form of cupola is used, however, of which a sectional drawing is given. The turret is in two parts, a lower cylindrical portion of which is attached to the frame of the car and is a fixture, and a rotatable turret above, likewise cylindrical. The latter is provided with rollers *A* running upon an inwardly projecting ring on the fixed turret. On the inner side of the ring are teeth engaged by the gear wheel *B*.

A pair of brackets attached to the rotatable turret carry the gun. These brackets also support the shaft on which the gear wheel *B* is fixed. The gear wheel revolves through the agency of the bevel gearing at *C* and a chain connected to the spindle *D*.

A bicycle seat is placed on the gun and the spindle *D* carries cranks and pedals. Thus the gunner, seated on the saddle, is able, by pedaling, to rotate the turret and with it the gun, leaving both hands free for aiming and operating the weapon. The scheme is certainly ingenious, but seated as he is astride the gun, the marksman must feel the full effects of the recoil.

So far as known, the English armored automobiles are merely light Daimler trucks of the subsidized type. Several successful raids have been carried out by Commander Samson, who is a member of the Naval Flying Wing.

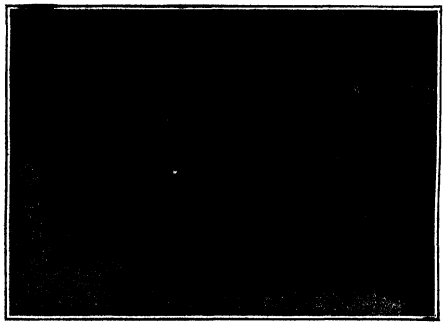
As Italy may yet be dragged into the conflict, the type of armored car on which she relies may be of interest. As seen from the accompanying photograph of an Isotta Fraschini, the type more nearly approaches a fort on wheels than any of the machines previously described. The lack of observation facilities at the sides is a point not above criticism. The rear wheels and under body are very well protected, as is the radiator.

An Italian artillery major de Santelron has produced an automobile battery consisting of four machine guns, two mounted on each side. The sides of the vehicle can be swung out to bring all the guns into line.

Strange as it may appear to Americans accustomed to self-starters on every form of automobile, not one car is, I believe, similarly equipped. Yet a moment's reflection will show the desirability, if not absolute necessity, of such a fitting. Several extremely narrow escapes have occurred already through one of the crew having to restart the motor when the car was under fire. It is to be hoped that all armored automobiles will, in future, possess engine starters.



Belgian touring car fitted with protective armor.



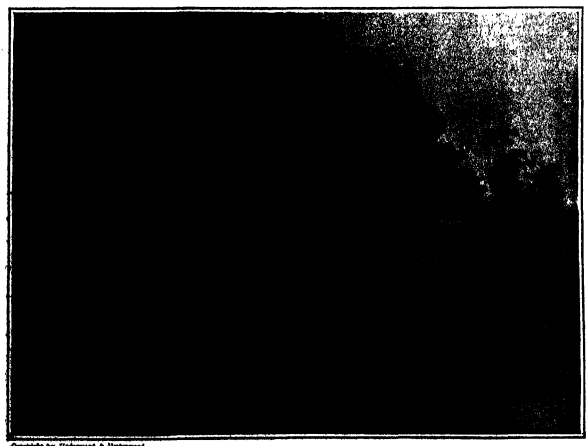
Type of car that has been used very effectively by the Belgian army.

Darwin's Theory No Longer Accepted

DARWIN'S theory of the origin of species has been generally accepted for many years, but since its enunciation the progress and discoveries of science have raised doubts as to its value. The necessity that every theory of evolution must be in accord with the more recently discovered facts of physics and of chemistry is emphasized by Prof. William Bateson, president of the British Association for the Advancement of Science, in his recent address at the meeting in Australia, in which he referred to the subject as follows:

I suppose that everyone is familiar in outline with the theory of the Origin of Species which Darwin promulgated. Through the last fifty years this theme of the natural selection of favored races has been developed and expounded in writings innumerable. Favored races certainly can replace others. The argument is sound, but we are doubtful of its value. For us that debate stands adjourned. We go to Darwin for his incomparable collection of facts. We would fain emulate his scholarship, his width and his power of exposition, but to us he speaks no more with philosophical authority. We read his scheme of evolution as we would those of Lucretius or of Lamarck, delighting in their simplicity and their courage. The practical and experimental study of variation and heredity has not merely opened a new field, it has given a new point of view and new standards of criticism. Naturalists may still be found expounding theological systems which would have delighted Dr Pangloss himself, but at the present time few are misled. The student of genetics knows that the time for the development of theory is not yet. He would rather stick to the seedpan and the incubator.

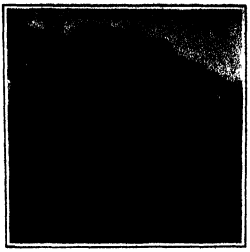
In face of what we know of the distribution of variability in nature the scope claimed for natural selection in determining the fixity of species must be greatly reduced. The doctrine of the survival of the fittest is undeniable so long as it is applied to the organism as a whole, but to attempt by this principle to find value in all definiteness of parts and functions, and in the name of science to see fitness everywhere is mere eighteenth century optimism. Yet it was in application to the parts, to the details of specific difference, to the spots on the peacock's tail, to the coloring of an orchid flower, and hosts of such examples, that the potency of natural selection was urged with the strongest emphasis. Shorn of these pretensions, the doctrine of the survival of favored races is a truism, helping scarcely at all to account for the diversity of species. Tolerance plays almost as considerable a part. By these admissions almost the last shred of that teleological fustian with which Victorian philosophy loved to clothe the theory of evolution is destroyed. Those who would proclaim that whatever is, is right, will be wise henceforth to base this faith frankly on the impregnable rock of superstition and to abstain from direct appeals to natural fact. My predecessor said last year that in physics the age is one of rapid progress and profound scepticism. In at least as high a degree this is true of biology, and as a chief characteristic of modern evolutionary thought we must confess also to a deep but irksome humility in presence of great vital problems. Every theory of evolution must be such as to accord with the facts of physics and chemistry, a primary necessity to which our predecessors paid small heed. For them the unknown was a rich mine of possibilities on which they could freely draw. For us it is rather an impenetrable mountain out of which the truth can be chipped in rare and isolated fragments. Of the physics and chemistry of life we know next to nothing. Somehow the characters of living things are bound up in properties of colloids, and are largely determined by the chemical powers of enzymes, but the study of these classes of matter has only just begun. Living things are found by a simple experiment to have powers undreamt of, and who knows what may be behind?



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Watching the effect of German shells at Antwerp from a Belgian armored automobile.

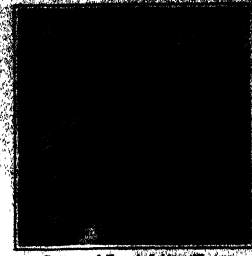
A world's record for milk production is reported in *Hoard's Dairyman* to have been made recently by a 7-year-old Guernsey cow, May Rilma, which in a 365-day test gave 19,839.5 pounds of milk, containing 1,059.50 pounds milk fat.



French Cuirassiers on the march.

An Army on the March

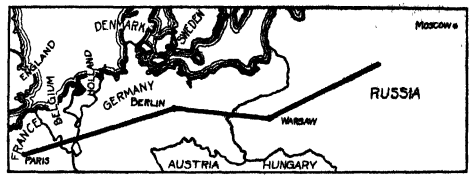
Orderly Sequence in Which the Units of a Modern Army Are Brought Up to the Battle Front



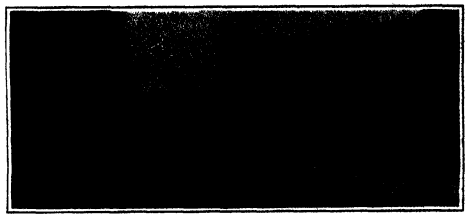
Battery of French field artillery.

ONE of the most important elements in the conduct of warfare is the rapid and orderly movement of the troops, whether in bringing them up to the front from the various mobilization centers, or in moving them from point to point, according to the exigencies of the campaign—the ever-changing fortunes of the field of battle.

To the layman, who has witnessed the gathering and dispersal of the few thousand spectators at a football or baseball game, it will be evident that the movement of bodies of men, running into the hundreds of thousands, is a matter calling for thorough forethought, method, and discipline.



The first German army of invasion of France (1,200,000 men), if marching on a single road, would have stretched from Paris 1,200 miles, to within 350 miles of Moscow.



A train of commandeered Paris autobusses passing through the forest of Compiegne.

As far as possible and almost invariably the march of armies, especially in settled countries, such as form the theater of the present European war, is carried out upon the highways. The order of march, the sequence of the various units, has been determined by long experience, and the diagram which incloses three sides of this page and represents a division of about 20,000 men, when on the march in the presence of the enemy, may be taken as broadly representative of a similar unit in any of the first-class armies engaged in the present conflict. Two such divisions constitute an army corps of 40,000 men, and three army corps make up a field army of 120,000 men.

Now the first thing, probably, that will surprise the layman in looking at this diagram, is the extraordinary length of road that is covered by 20,000 troops on the march. The distance from the head of the advance cavalry to the last wagon of the supply train is 21½ miles. This means that if it were advancing by a single road and were covered by a single body of advance cavalry serving for all the troops that followed, an army corps would reach 41 miles and a field army for a distance of 120 miles.

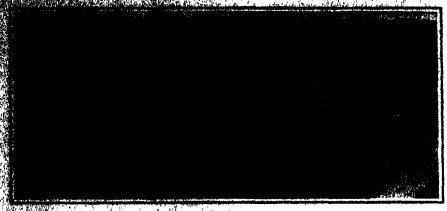
It has been estimated by some of the military critics that the German army of invasion of France was composed of 1,200,000 men. If so, and the Germans could have marched unopposed into Paris, and if we imagine that army marching by a single road, stretching from west to east, at the time when the advance cavalry reached the Arc de Triomphe, Paris, the tail of the German host would be 1,200 miles distant. The column would reach through France, Belgium, across Germany and some 500 miles beyond the Prusso-Russian boundary to within 400 miles of the city of Moscow.

The enormous size of modern armies necessitates advance upon a wide front and

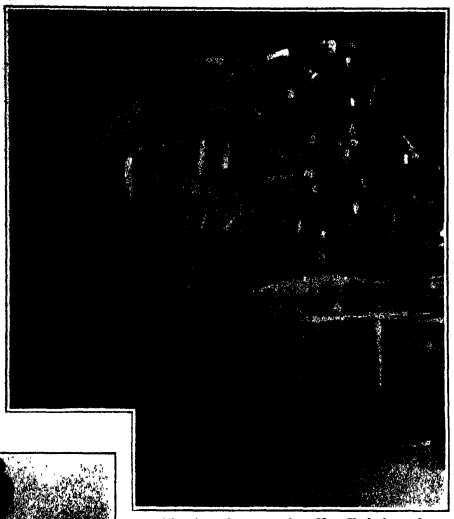
(Concluded on page 396.)

This diagram, drawn to scale, shows the length of road occupied by the various units of a division of 20,000 men on the march in the presence of the enemy.

AN ARMY ON THE MARCH



Bomb-proof shelter abandoned by the Germans.



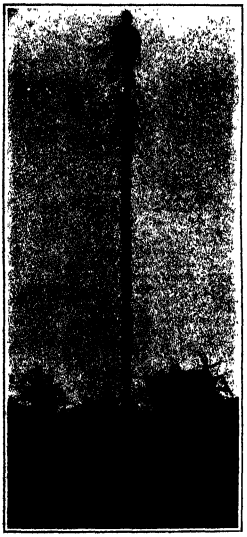


English gun captured by the Germans at Antwerp.

Pile of trunks returned to New York from the war zone.



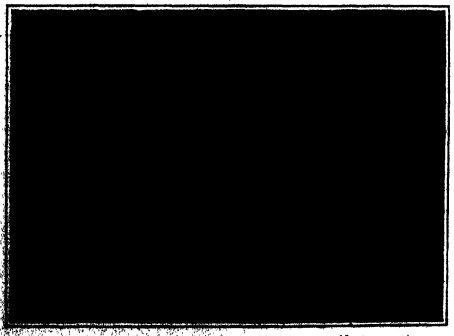
Air-cooled machine gun on an aeroplane.



Mast built of steel ribbons.



Observation post at the top of the mast.



Unemployed military meteorologist has an accident.



Loading guns at Capetown for the European war.

PICTURES FROM THE FRONT

Letters from the Firing Line

Tricks of Warfare

By Aide-de-Camp Xavier Sager, Special Correspondent of the SCIENTIFIC AMERICAN at the Front

WAR! All the efforts of our brains, all the descriptions which we have read again and again, all the visions of battles which we have tried to conjure up in our overheated imaginations, do not approach the terrible reality. He who has seen this frightful yet magnificent spectacle with his own eyes will retain the memory of it forever.

All along the roads and the fields can be seen the vestiges of numerous trenches. We have fought here ardently for a month, and slowly, step by step, we have forced the enemy to retire.

In the north they have filled up the ditches where the corpses lay deep, and it now might be considered as one continuous, one endless grave. Every now and then an insufferable odor chokes you. A soldier, a horse has fallen there, and slowly is decomposing. It has been impossible to gather all the bodies in the vast trenches.

The roar of the cannon is heard in the north, however; it is hardly possible to define exactly where the shell fell. This morning my regiment met on the road another regiment: "Well! What are you doing?" we ask. "Digging! And you?" "The same—nothing but digging."

At the actual hour the armies can be classed in two categories—one half is digging trenches in order to fight and the other half is fighting to dig trenches.

A study of our trenches will show why the progress of the armies is so slow. They outline most of the trenches as they have been established by the enemy. The infantry when entering them are entering real fortresses. They are sheltered from view, from the shells and from the rain.

Neither our artillery nor our infantry can see the Germans encased in them. To reach them it is necessary that our shells fall exactly in the trenches. The battle is no more a fight in the open; the offensive takes the character of a hunt; the danger everywhere comes from underground. Before fighting the enemy we must unearth him.

Moreover, when we realize that the German artillery has also its fortified works; that everywhere it surrounds itself with wire netting in order to stop the assailants; that between the cannon mitrailleuses are concealed, the purpose of which is to act against our infantry; and that behind the field artillery is placed the heavy artillery, whose far-reaching shells are able to protect the retreat with a wall of fire, then we can understand the effort demanded of our troops to displace the German army from its positions and to drive it from the woods and the hills where it seemed to have taken root.

The Germans have come on the battlefield with a certain number of tricks and stratagems which, during the first five weeks of the war, gave them a certain superiority. But the French race is endowed with a prodigious facility of assimilation. It did not take us long to scent the tricks and to adapt ourselves to the German stratagems. In fact, at the very moment I am writing these lines, our infantry is executing some works of art which, in the matter of strength, durability, and finish, can compete with all the mole-traps that the Germans left behind them as samples, at the time of their swift retreat from the Marne last September. The officers of the engineering staff had only to give the measurements and the men started the work. The regiments of reservists and territorials have even succeeded better at first than those of the active army, and the reason of this is that they are composed of a marvelous gathering of all professions and all capabilities. The farmers took the pick-ax to dig; the bricklayers were given charge of the battlements (*crenelage*); the wood-cutters busied themselves with the hewing of poles and brush for roofings, the plumbers laid out the drainage ditches, and French wit not losing an opportunity, the painters and sculptors erected some amusing statues made of clay at the back of the sections, destined to protect us from shells.

Many times the Germans, in order to deceive the aim of our guns, dug dummy trenches, where they placed dummy soldiers, surmounted with dummy helmets. These were made of a handful of straw, which they had rolled and plaited, and whose point they had dipped in brass paint. But in the matter of dummy trenches they had nothing on us, and we had a few good ones up our sleeves, which I am not permitted to disclose now, but which I hope I will have, later on, the pleasure of describing at length. The Germans have already had a taste of it; it is dangerous for them to try a bout with French wit.

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In fact, our trenches are so comfortable that we hate to leave them. One of my friends, who stayed eight days in his, had worked a great many improvements, which made it look almost like a home. He had dug an excavation to be used in the capacity of a cupboard, where he would store his food; a sort of step made of soft earth proved a fairly acceptable pillow, and he had given the proper inclination to the board that was his bed—in a word, it was a real subterranean palace.

To verify the accuracy of the fire of their artillery the Germans are very ingenious. For instance, they will send a reconnoitering party of Uhlans, which marches straight ahead and gets into contact with the position of the Allies, and which then signals these positions to their artillery. To this effect they select the high steeples of our churches, using them as gigantic torches.

They climb to the summit of the church steeple, pour gasoline on the woodwork and set fire to it. As soon as the Germans notice this signal their artillerymen see where to aim and know exactly where they must direct their fire.

Spying is one of the great features of German strategy. Among many others, here is one of the cunning ways used very frequently among the German spies: Some men dressed as civilians and placed in different spots occupied by the enemy give the Germans the indication of our positions by means of fires of certain colors during the night, and of smoke in the chimneys of the houses during the day.

Pretended peasants have been discovered in the fields whose occupation was to gather information. German officers, dressed as civilians, were also found in the localities evacuated, their purpose being to establish some connection with their own troops. One was found in a high steeple, where his presence was given away by the strange oscillations of the clock's hands, which had been for the time being transformed into an improvised semaphore.

The women also help in spying. They watch the embarkment and disembarkment of our troops.

It has just been discovered that the spies who kept the army of the famous Gen. von Kluck informed were using a very old way of proceeding, very romantic indeed, that of the gypsies, the vagabonds, and the tramps, who, as a means of corresponding with each other draw varied figures on the walls of the farms and houses along the road. One thinks he is looking at the artless drawings of a child, while these awkward lines have a precise significance, and the smallest detail is full of meaning. Moreover, the German spies have lately copied a burglar's trick, and this is how: On the walls are seen some simple drawings, which do not attract attention, and before which no one would stop. The design, for instance, represents a cow, the face is artlessly drawn, however easily discernible. Sometimes the cows are of small dimensions, or medium, or very big. Some are looking one way, some another. Certain of them have the head raised toward the sky. These cows were drawn by the scouts. A small cow meant that the road was poorly guarded; a bigger one that there were French troops in the neighborhood; and a still bigger cow that a fort or some important work of defense was to be found near by. To render the information more precise, the orientation of the cow's head gave indications as to the dangerous spots to be avoided, or to be watched. As for the cows looking toward the sky, their meaning was that before advancing any farther it was necessary to explore the surrounding country.

There are many tricks that we must accept as belonging to warfare, and that we ourselves practise when the occasion comes.

A regiment of our cavalry sighted a German battery, which was near and was firing in the opposite direction. Concluding that the Germans were not aware of their presence, the French charged the enemy. In the valley a wire net, cleverly hidden, had been stretched by the Germans; our calavry was caught in the trap, and the German battery, changing its aim, turned its fire upon our troops, who lost heavily.

By way of retaliation we have played more than one trick upon them. For instance, a French general, through his wit, forced the evacuation of a German stronghold. He first opened fire upon it with a great many pieces of artillery, reducing their fire one by one as if the shells of the enemy had silenced them. One only was left to work. The silenced pieces had been sent, without attracting the attention of the Germans, to a position where they had entire command of their entrenchment. Their order was to reach their destination as quietly as possible and to await the signal of attack. As soon as this signal was given they opened fire and the enemy was completely routed.

A method which is frequently employed by our army to demoralize the enemy is to send, at night, a detachment of heavy cavalry across the German bivouacs; this detachment sets fire to the army convoys, the automobiles, emptying over the ground the cans of oil and gasoline, and causes great material losses, besides terrorizing the troops of the enemy.

A scout aviator had flown a good distance over the German territory. On his return his motor was stalled, making it necessary for him to descend. Suddenly some German soldiers with an officer appeared from behind a thicket. The aviator was completely dressed in leather and nothing showed his nationality. In a tone of authority he ordered the officer in German to come to his aid, and the latter hurried to obey. A few minutes afterward the aviator resumed his flight. When he had reached a safe distance the aviator sent to these Germans a paper, on which he had scribbled his thanks for the assistance they had given to a Frenchman.

Persian Lambskins and Karakul Sheep.

WHAT is "Persian lamb"? This fur is well known in America, yet trustworthy information concerning it is hardly to be found in any of our encyclopedias or other reference books.

According to a bulletin just published by the Department of Agriculture, true Persian lamb does not come from Persia, but from Bokhara, and not from the young of the breed of sheep known as Persians, but from karakul or Arabi sheep. The Persian lambskin is known by such other trade names as krimmer, astrakhan, and broadtail, these terms denoting somewhat different grades, but practically all the skins come from Bokhara and adjacent parts of Russian Turkestan. They are now greatly in demand in this country, a single firm in New York importing from 200,000 to 250,000 skins a year. The result of this demand has been extensive crossing of the sheep, so that, it is said, there are not more than 5,000 pure-bred karakuls in existence, most of which are found on the estates of Bokharan noblemen. Their exportation from Bokhara is now strictly forbidden by law.

The karakuls are one of the fat-tail breeds of sheep and are thus described:

"The head is strikingly characteristic of the breed, the face being narrow, and the top of the head and fore part of the skull much rounded. The rams ordinarily have beautiful outspreading spiral horns, but the ewes are generally hornless. The ears are small and pendulous, especially so in the lambs. The face and legs of the adults are covered with short, lustrous black hair, while the wool of the body is coarse, long, and varies in color from gray to black. Very hard outer wool and the absence of soft under wool are said to be indications of purity of blood."

The young lambs are usually jet black, with a lustrous wool closely curled over the entire body. When used for fur, they must be killed when not older than ten days, as the curls open after this period. The practice of using the skin of the unborn lamb, which necessitated killing both lamb and mother, no longer prevails. Good skins sell for from $10 to $15. The ewes are milked for a time after the lambs are killed, and a famous cheese known as Brinsa is made from the milk. The mutton of the karakul sheep is said to be the most palatable of any breed, and their fat is used by the Bokharans instead of butter.

Golden-brown lambs are occasionally dropped. This is the color of the prophet Mohammed, and such skins are highly valued in consequence.

The first karakul sheep ever seen in America were imported by Dr. C. C. Young of Belen, Texas, in 1908. Dr. Young published a newspaper article last January describing the many difficulties he encountered in obtaining and bringing over these animals, and the, at first, disappointing results of the attempts to breed them in this country. A few more were imported by him in 1912. According to the Department of Agriculture, flocks have been established in Texas, New Mexico, Kansas, and Prince Edward Island, and numerous experiments in crossing with other breeds have been undertaken, but the results still seem to be problematical. On the other hand, Dr. Young claims that the problem of producing a high grade of Persian lamb in this country has been fully solved.

[illegible]

Pertaining to Apparel.

[illegible] PROTECTOR.—J. B. Eastman, 43 [illegible] St., Newport, R. I. This invention provides a leather covered metal plate which may be secured to the inside of a shoe just above the heel after the shoe is completed or at any time during the course of its wear, and which will prevent nails from tearing stockings and also from injuring the heel of the wearer, thus avoiding the danger of blood poisoning or other ill effects.

BOOT AND SHOE.—J. Jefferson, 444 South 6th St., East, Salt Lake City, Utah. This invention relates to improvements in boots and shoes and has for an object to provide a structure adapted to connect or draw together the uppers quickly and easily, while presenting means for properly holding the same in position.

HOSE SUPPORTER.—A. M. Wilson, care of A. M. Wilson Co., Cherokee, Iowa. The invention provides a supporter with a button plate having one or more slots, and a button secured thereto, there being a flexible or web member having an opening, through which the button is disposed, this member extending over the button plate and through one or more of the slots, by which means it is held in position on the button plate.

Pertaining to Aviation.

HULL FOR HYDROAEROPLANES.—C. H. Pusey, 48 Henry St., Brooklyn, N. Y. The general objects of this invention are to provide a floating hull for a hydroaeroplane which is of such construction that it has great flotation power, offers comparatively little resistance when traveling in the water, is easy to steer, and possesses great stability, and furthermore, in flight it has a lifting power of its own.

Electrical Devices.

AUTOMATIC TELEGRAPH SYSTEM.—D. H. Cameron, Box 428, North Sydney, Nova Scotia, Canada. This invention relates to telegraph systems of the automatic type whereby the incoming signals in the form of dots, dashes, and spaces are automatically recorded. The invention improves and simplifies telegraph systems of the above character so as to be more reliable, efficient and expeditious in service; and so designed that only one operator is required to operate the apparatus in receiving a message from one distant station and transmitting it to another distant station.

ELECTRIC LAMP MOUNT.—E. S. Keogh, 122 Livingston St., Brooklyn, N. Y. This inventor provides a mount for low-voltage electric lamps, to hold the same in operative position upon an electric battery element; provides a means for employing an electric lamp in connection with a single electric-battery element; and provides means for, at will, temporarily or continuously maintaining a closed circuit incorporating a lamp of the character named.

WAVE DETECTOR.—R. T. Ackley, Cortland, Ohio. This invention refers to wave detectors of the kind employed in wireless communication, the more particular purpose being to produce a detector which is particularly sensitive to the action of electro-magnetic waves and which is also self-restoring.

ELECTRIC RAT TRAP.—C. W. N. Palmer, R. F. D., No. 1, Mercersburg, Pa. In this trap the rodent is killed by an electric shock and its body deposited in a proper receptacle. Means provide whereby the trap when once operated will automatically reset itself, thus doing away with the necessity of setting the trap each time it is used.

Of Interest to Farmers.

CATTLE GUARD.—H. P. Spencer, R. F. D., No. 8, Shelbyville, Tenn. This invention refers to cattle guards for preventing the movements of animals along a railroad track, and more particularly to that class of guards including a vertically swinging gate actuable by a platform under the weight of cattle or other animals standing upon the platform.

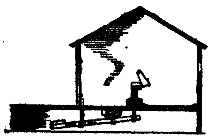
CHAIN REEL.—A. A. Beals, Clarence, Mo. The invention relates more particularly to a reel to be used on all types of grain harvesters, such as self-binders, headers, and combined machines, the purpose being to provide a reel which may be mounted low down on the machine frame and which will not interfere in any way with the vision of the operator from his seat.

THRESHING MACHINE.—S. G. Gudmundson, Conrad, Mont. In this machine a means provides for dislodging the grain from the straw, so arranged that the grain will be twice acted upon, and wherein means is provided for adjusting the said dislodging means to provide for different conditions, and wherein there will result economy of first cost, upkeep, and amount of grain saved.

CABBAGE HARVESTER.—A. B. Warren, [illegible]

the same rate of speed that the frame moves forwardly, so that the cabbages will not be turned over should they be pulled up.

TRAP NEST.—A. G. R. Kellen, 1558 Verdi St., Alameda, Cal. This invention relates to trap nests utilized for trapping hens in order that accounts may be kept of the numbers of eggs laid by each hen, and the object of the



TRAP NEST.

invention is to provide a construction for accomplishing this purpose, of such a nature that there will be minimum danger of frightening the birds either as they enter the nest or are trapped therein.

WAGON SCALE.—W. C. Price, 314 Juniper Ave., Long Beach, Cal. This inventor provides a scales especially adapted for use in farming districts for the weighing of wagon loads, such as loose hay or like materials, requiring the use of platform scales, such scales being often many miles distant from farms in the farming districts of the West.

STUBBLE BURNER.—A. Ward, Bowbells, N. D. This burner may be moved to a position over the stubble which is to be burned, the frame of the burner carrying an apron at one end and shoes at its side for confining the fire under the top of the burner. The apron and shoes are adjustable to permit of their being raised when the burner is moved over a field and means are provided for spraying oil under the top of the burner, the oil being carried by a tank on the frame.

DITCHING PLOW.—B. A. Jordan and E. J. te Grotenhuis. Address the former, Crawford, Colo. The purpose here is to provide a simple and easily operated device, by means of which a plurality of parallel ditches or grooves may be marked off, wherein the distance between the grooves may be varied at will, as also the depth of the groove.

THRESHER.—G. W. Carpenter. Address Willard E. Holt, Deming, N. Mex. This inventor provides a machine for beating out and separating grain, peas and beans, and at the same time feeding the straw through the machine, the structure and arrangement being such as that it may be operated with greatly reduced power compared to that necessary in connection with the threshing machines now in general use.

CORN SAVING AND CLEANING DEVICE.—G. A. Stevens, 520 Center St., Elgin, Ill. This invention relates to means whereby the shelled corn can be saved and collected in clean condition. The fact that the husks and shelled corn are intermingled makes it especially difficult to separate corn in clean condition and at the same time to effect the removal and conveying of the husks.

IRRIGATION DEVICE.—L. B. Demuth, Beidler, Ohio. The invention provides a water supply or main pipe with connections from it to a distributing nozzle pipe extending along above the surface of the earth to be irrigated any desired distance, said pipe line or nozzle pipe being provided with perforations for spraying the water laterally from the vertical plane of the pipe.

Of General Interest.

INTERIOR COLLAPSIBLE FORM FOR CONCRETE BURIAL VAULTS.—J. G. Johnson, 803 Main St., Carthage, Ill. The purpose here is to provide an interior collapsible form whereby the base, side, and end walls of a concrete burial vault may be conveniently formed in such a manner as to permit of the subsequent formation of a top for the vault whereby the same may be sealed.

ACTION FOR KEYED ZITHERS.—F. Menzenhauer, 22 Sherman Place, Jersey City, N. J. This invention provides a keyboard attachment for stringed musical instruments of the zither type and arranged to permit convenient adjustment of the actuating parts and to allow of producing a tremolo effect whenever it is desired to do so by the player.

SPOOL HOLDER.—R. Fraser, care of Russell Fraser Wire Co., 128 Wythe Ave., Brooklyn, N. Y. The intention in this case is to provide a holder arranged for convenient attachment to a wall, bench or other support, to allow convenient unwinding of the wire from the spool in length as needed, and to hold the wire on the spool against tangling up.

SHIPPING BOX FOR UMBRELLAS AND CANES.—S. H. Roberts, 361 E. 7th St., Brooklyn, N. Y., and G. W. Schaeffer, New York, N. Y. This invention has reference to an improved shipping box for umbrellas and canes designed more especially to permit the shipping of umbrellas, canes and the like through the mails and by express and to prevent their breakage.

MANUFACTURE OF CELLULOID OR LIKE SUBSTITUTES.—L. L. T. Lasse, 3 Rue Henry Say, Asnieres, Seine, France. The present invention has for its object the manufacture of uninflammable substances which are insoluble in water, and which are more particularly intended for replacing celluloid in its various applications. In the process the property of albuminoid solutions of precipitating solutions of silica in the form of collo-silicates, insoluble in water is utilized, and also the employment of the silico-glyceric jelly combined with these collo-silicates.

CLEANING DEVICE.—Jerry Carleton and A. L. De Long. Address the former, Sioux Falls, S. D. One of the principal objects here is to provide a device whereby gasolene, benzine, ether, and other volatile and explosive liquids employed in dry cleaning, as well as soapine and other compounds employed in scouring articles of clothing, laces, tapestry, etc., may be safely, conveniently, and economically used.

Hardware and Tools.

CORK EXTRACTOR.—G. J. Davison, 719 East Grace St., Richmond, Va. The purpose here is to provide a combined cork and extractor which will in no way impair the ordinary function of the cork and which has movements to a position beyond the end of the cork when in use and to a position wholly concealed within the cork when in disuse, this movement being limited by means serving to unite the cork and its extractor.

VALVE GRINDING TOOL.—H. R. Parsons, Sharpsville, Pa. This invention provides an attachment which may be used with a valve grinding tool such as one forming the subject of a patent serial No. 789,651, said attachment adapted to engage valves having a pair of spaced holes or recesses instead of the usual screwdriver slot, whereby the valves may be rotated in grinding the same.

LOCK.—H. Adler, 1221 Brook Ave., Bronx, New York, N. Y. This inventor provides a lock particularly well adapted for use on elevator doors, the lock having a bolt with a threaded shaft connected with a cylinder or other locking means. A latch bar is provided for engagement by the bolt for locking the latch bar relatively to the bolt.

NOZZLE.—C. J. Myers, 239 Churchill Ave., Utica, N. Y. This nozzle has a split casing having ports, and means for holding this casing against two companion valve members which have cone-shaped members facing each other, each of the valve members having a projection seated between the casing and the cone-shaped member on the other valve member, the projections being spiral shaped and spaced from the axis of the nozzle, so that one of the valve members may be rotated relatively to the other valve member, to close the opening in the casing between the two ports or to leave a spiral opening through the casing of the nozzle from one port to the other.

Heating and Lighting.

CHIMNEY SWEEPER.—C. E. Anderson, Crystal Falls, Mich. This inventor provides a device for cleaning chimneys having other than circular cross-section, capable of being drawn through a chimney, and having mechanism for thoroughly cleaning the walls of the chimney during the passage through the same, and wherein the sweeper is adjustable and capable of cleaning the walls thoroughly, whether or not the chimney is straight.

STOVE.—J. C. Ziegler, Wichita Falls, Tex. One of the principal objects here is to provide a heating stove adapted to utilize artificial or natural gas to equal advantage, the construction and arrangement of parts being such that a thorough combustion of the gas is assured and maximum utility of the heat units is attained.

LANTERN.—J. Nielson, Bandon, Ore. This invention provides a device wherein the chimney is mounted for guided movement toward and from the burner, and is normally spring pressed upward, away from the burner, to facilitate lighting the lantern, and wherein releasable latch mechanism is provided for normally holding the globe in proper position with respect to the burner.

Household Utilities.

WINDOW SHADE.—D. Spivak, 491 Oak St., New Haven, Conn. This improvement provides means for ventilating a room provided with a curtain shade, the ventilators being incorporated in the shade; provides a shade with ventilating apertures arranged to obstruct light while giving free access of air; and provides means whereby shades constructed as outlined may be rolled as in the conventional manner.

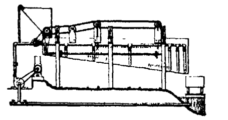
SAD IRON.—C. A. Beach, 55 Greene St., Brooklyn, N. Y. An object here is to provide a heating structure for sad-irons which may utilize at the will of the operator a plurality of sources of heat supplying fuel. A further object is the arrangement in a sad-iron of heating means formed to utilize a supply of gas and air furnished from either end of the iron.

RECEPTACLE CAP.—J. H. Follen, 214 Exchange St., Kenosha, Wis. This invention refers more particularly to caps for jars or similar vessels. The aim is to provide a cap of sanitary material, such as glass or porcelain, which can be easily removed and cleaned; and which is mounted to positively close the mouth of the receptacle.

IRONING MACHINE.—C. W. Sadler, Box 657, Windsor Locks, Conn. The purpose in this case is to provide a machine in which a number of small cylinders are used and means associated therewith for causing the opposite sides of the matter being ironed to engage some of the cylinders, while still in a moist condition.

Machines and Mechanical Devices.

SLUICE AND ORE CONCENTRATOR.—C. S. Richardson, 336 W. Ave. 51, Los Angeles, Cal. All water is admitted through double-slotted pipes, crossing the bottom of the sluice at intervals of several inches apart, the inner pipe being adjustable so as to give control of the width of the slot, thereby controlling the water admitted. Water is forced into the pipe under pressure and controlled by valves at

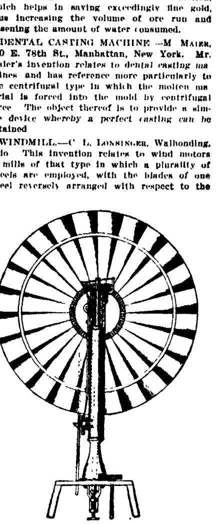


SLUICE AND ORE CONCENTRATOR.

either side of the sluice, giving absolute control of both volume and pressure of water at each pipe. An adjustable tail gate puts any portion of all materials in suspension, thereby giving the heavier material a chance to participate. The sluice is hung in an adjustable frame and given an eccentric side motion, which helps in saving exceedingly fine gold, thus increasing the volume of ore run and lessening the amount of water consumed.

DENTAL CASTING MACHINE.—M. Maier, 150 E. 78th St., Manhattan, New York. Mr. Maier's invention relates to dental casting machines and has reference more particularly to the centrifugal type in which the molten material is forced into the mold by centrifugal force. The object thereof is to provide a simple device whereby a perfect casting can be obtained.

WINDMILL.—C. L. Lonsinger, Walhonding, Ohio. This invention relates to wind motors or mills of that type in which a plurality of wheels are employed, with the blades of one wheel reversely arranged with respect to the



WINDMILL.

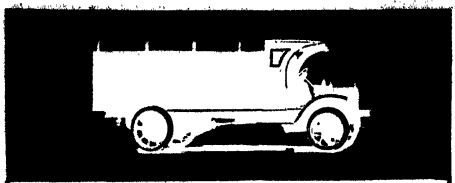
blades of the other wheel, so that the wind after acting on one wheel is deflected by the vanes thereof to act on the other wheel for the purpose of obtaining a greater power from the wind than is possible with a single wheel.

PROJECTILE.—L. F. Hering, Box 266, Pomona, Cal. This device is discharged through the air by means of a plurality of guns of large caliber and great power, and wherein the projectile is in the form of a wheel laden with explosives timed to discharge at a predetermined moment, and provided with laterally extended swords or sabers, and wherein mechanism is provided for supporting the projectile, and for imparting rotation to the flywheel before it is discharged from the guns. Means provide for supporting and guiding the projectile at the commencement of its flight.

LACE MACHINE.—J. Farigoule, 40 Rue des Jeuneurs, Paris, France. In the present patent the invention has for its object a machine for the manufacture of all kinds of lace made by hand by means of bobbins, the machine being combined so as to carry out all the operations effected in manufacture by hand.

INGOT MOLD.—H. Jouanneau, 11 Rue du Printemps, Paris, France. This invention relates to rotary molds. By means of such a mold rapidly rotated the metal is subjected to centrifugal pressure, with resulting increase of density and cohesion, causing homogeneousness if the metal be single and thorough mixture of elements throughout the mass in the case of

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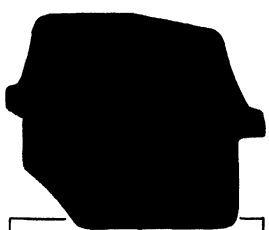
Our 1915 Truck Tire

For fifteen years the Goodyear Tire & Rubber Company has been developing Truck Tires. For the last eight years this work has been principally on heavy service tires.

In this time, the men in our Experimental Department have solved a legion of tire problems. The work they are constantly doing to perfect Goodyear Tires costs us $100,000 a year.

This Goodyear Experimental Department has built 29 different types of Truck Tires. In the evolution of one type—the 1915 Goodyear S. V. Truck Tire—74 separate tire structures were built. Each was watched and tested for utmost efficiency. In the last year and a half 2,100 test tires have been placed in actual use, under every working condition.

The result is the 1915 Goodyear S. V. Truck Tire. This 1915 tire marks today's finality in truck tire service, durability, simplicity, economy. It is the sum of all that has been done in the attainment of truck tire perfection.



Some New Features

The Goodyear S. V. is a metal base tire of the pressed-on type. Wonderfully simple. No tire is applied more quickly, easily or securely. It cannot be applied wrong. There are no rights and lefts.

It is lighter than others—due to a total absence of cumbersome metal wedges, flanges, bolts and bands used to keep other tires in place.

It has a flat tread—which means better load distribution, better traction and a uniform wearing quality.

The metal base is a corrugated channel, to which is vulcanized a layer of hard rubber Then comes the tread rubber. By a Goodyear process, the metal, the hard rubber and the soft rubber tread are all welded together into one inseparable unit.

Less Cost Per Tire-Mile

Ask us to show you how big concerns in every field are lowering tire-mile costs by using 1915 Goodyear S V Truck Tires. Learn also how these tires save equipment—the load—the driver's time—*how they keep the truck in commission.*

Before buying tires remember what Goodyear has done to insure the service and economy you seek Goodyear S. V Truck Tires eliminate guess-work and experimentation

Get Goodyear experience when you buy Truck Tires.

THE GOODYEAR TIRE & RUBBER COMPANY, AKRON, OHIO

Makers of Goodyear No-Rim-Cut Automobile Tires

(199)

The Japanese Navy

(*Concluded from page 274.*)

45-caliber 6-inch and twelve 45-caliber 4.7-inch guns—an enormous battery to be carried on such a limited displacement. The vessels are protected by a 7-inch belt. Mounting the 12-inch gun, they form an intermediate link between the armored cruiser and the battle-cruiser.

The next step of the Japanese in the development of this type was shown in those fine ships, the "Kurama" and "Ibuki," of 14,600 tons and 22 knots speed. They mount four 45-caliber 12-inch and the 6-inch battery is replaced by eight 45-caliber 8-inch, supplemented by fourteen 50-caliber 4.7-inch guns. These vessels were completed in 1909 and 1910, and both of these ships and the two previously described were designed by the Japanese and built at their yards.

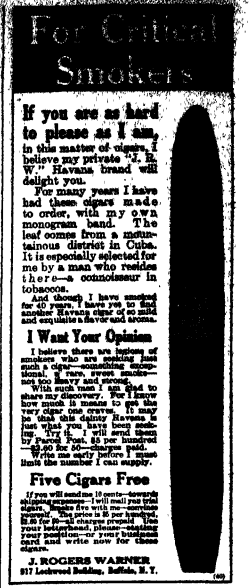
The next Japanese effort was the construction of a battleship, the "Satsuma," of 19,400 tons displacement and 18¼ knots speed. Had the speed been greater, 20 to 21 knots, this ship would have been entitled to rank as a dreadnought, but her moderate speed of 18¼ knots places her in the semi-dreadnought class. Her main battery is extremely heavy, consisting of no less than sixteen large pieces, namely, four 45-caliber 12-inch and twelve 45-caliber 10-inch. There is also a torpedo-defense battery of twelve 45-caliber 4.7-inch guns. The belt is 9 inches in thickness.

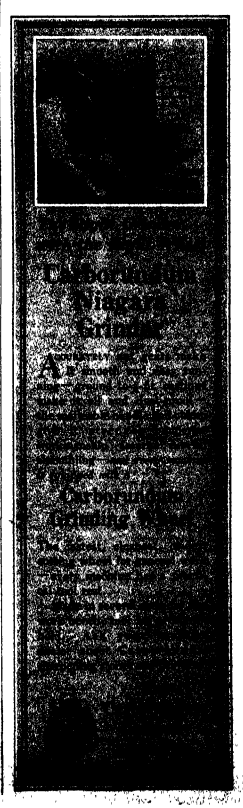
In the following year the Japanese completed the dreadnought "Aki," a fine ship of 19,800 tons, 20 knots speed, mounting four 45-caliber 12-inch, twelve 45-caliber 10-inch, and a torpedo battery of eight 45-caliber 6-inch guns. Her belt is 9 inches in thickness. The 12-inch guns are carried in two turrets forward and aft, and the 10-inch guns are mounted in twin turrets, three on each beam.

In 1912 and 1913 the Japanese completed in their yards the dreadnoughts "Kawachi" and "Settsu," of 21,420 tons displacement and 20 knots speed. The battery consists of twelve 45-caliber 12-inch guns and a torpedo battery of ten 50-caliber 6-inch guns. The belt armor is 12 inches in thickness The six two-gun turrets are distributed on the faulty plan at first favored by Germany, two turrets being mounted on the center line, one forward and one aft, and two on each beam. This system has the defect that four guns are out of action during a broadside engagement.

In the next addition to the navy of four battle-cruisers, the Japanese made a great jump in size, power, and speed. In 1913 they completed at Vickers's Works, the "Kongo," and in the present year at their own yards they built the "Hi-Yei." Two other ships of this class, the "Haruna" and "Kirishima," are under construction in Japanese yards. These fine vessels, of 27,500 tons, are protected by a 10-inch belt, and have a speed of from 27 to 28 knots. They mount eight 45-caliber 14-inch guns and sixteen 50-caliber 6-inch. These ships form a division which, for its speed and fighting power, are equal, if not superior, to any vessels of their class in the navies of the world.

We present a fine wash drawing by Oscar Parkes of a class of four super-dreadnoughts of 30,600 tons displacement, which are under construction in Japanese yards and are down for completion, respectively, in the years 1915, 1916, and 1917. They will be known as the "Kure," "Yukosaka," "Kawasaki," and "Mitsubishi." They will have the great length of 673 feet, and their turbines, of 40,000 horse-power, are expected to drive them at a speed of 22½ knots. The belt armor will be 12 inches at the water-line, with upper belts, respectively, of 9 inches and 8 inches in thickness. They will have the same battery as our "Pennsylvania"; but they will carry their twelve 14-inch guns in six twin-gun turrets instead of four three-gun turrets. The Japanese doubt the wisdom of placing three guns in a single turret, which, if it were disabled, would put one third of the main battery out of action. The torpedo-defense battery will consist of sixteen 50-caliber 6-inch guns, well above the water on the main deck.





[illegible] ... piston of the pendulum swings forward and the rudders are elevated; the reverse movement taking place if the immersion of the torpedo is not sufficient. When a torpedo dives into the water, the first part of its run is made on a wave line, which crosses and recrosses the desired and ultimate level of immersion, the piston and the pendulum together gradually bringing the torpedo to a true course.

Only a few years ago, comparatively speaking, the lateral course of the torpedo was decidedly uncertain. The range and speed had been greatly improved, but the torpedo still had a way of departing suddenly and mysteriously from its intended course—sometimes coming back at the vessel from which it was sent to the no small dismay of all hands. At this critical stage in the history of the torpedo, the Obry gear was invented. Briefly, the Obry gear consisted of a gyroscope placed within the torpedo and so connected by intermediate power mechanism with the directive rudder that the weapon could be held to a fairly straight course. The original Obry gear had a spring impulse, its directive force rapidly diminishing from the instant of starting, and it became quite useless after the torpedo had run something over a thousand yards. The next developments introduced an air-impulse, turbine-driven gyroscope, and then an electrically driven Obry followed. These have done away with the shock of the original spring impulse and have naturally greatly increased the directive value of the gear, besides making it possible to fire the torpedo from a broadside and cause it to swing automatically through an angle of 90 degrees toward a target dead ahead. From a weapon that was a menace to friend and foe alike, the installing of the gyroscope has revolutionized the automobile torpedo, making it under some conditions even more certain of hitting its mark than even with the biggest of our modern guns.

For years the wonderfully compact and efficient three-cylinder Brotherhood engine was the most reliable motor for the automobile torpedo. The latest torpedoes are driven by a small impulse turbine.

All the while that the torpedo was improving in military value, the range of modern guns on shipboard was likewise undergoing substantial increment, making it possible for ships to fight at greater distances, and the torpedo expert realized, despite all that had been done to make his weapon more effective, that both the range and speed of the torpedo must be further increased if it were to meet properly the changed conditions. At this stage, American inventive skill found a way to surmount the obstacle. Mr. Frank M. Leavitt, of the E. W. Bliss Company, made the startling proposal to heat the air stored in the flask, and thus to cause its expansion and multiply its propulsive capacity. The first American development of the superheater for this purpose consisted of means (see S H in sectional view) by which alcohol could be burned within the air flask—the heated air passing thence through the valve system to the engine or turbine and, while still relatively warm, passing outboard through the exhaust. Apart from propulsive advantages, superheating obviated another objectionable feature of the older system in which the changes of temperature were so great—due to the rapid expansion of the compressed air—that the exhaust was frequently far below the freezing point. This caused the lubricants to congeal and, in turn, impaired the action of moving parts. The British development of the superheater omitted the alcohol flame from within the air flask and put it between the reducing valve and the motor. This was an advantage in some ways: it did not require the heated air to pass through the delicate valve system, it fed into the [illegible] at its most efficient [illegible] possible a [illegible] [illegible] the engine or turbine. However, like all good things, it had a drawback from a military point of view. When the air flask of one of our torpedoes is fully charged, the actual weight of that compressed air amounts to something like 191 pounds. The reducing valve, which regulates the pressure and supply of air to the motor—standing sentinel between the air flask and the propulsive mechanism—is designed to maintain a feed pressure of 300 pounds for the turbine impulse. When the pressure in the air flask approaches 300 pounds, the run of the torpedo is substantially at an end so far as its useful military speed is concerned. As the air in the air flask expands, due to its gradual escape to feed the motor, the temperature is lowered sometimes even to below zero, and this remaining air is incapable of expelling itself from the flask for the purpose of effecting the propulsion of the torpedo. It has been found that when the superheater is outside of the air flask, of the total weight of 191 pounds of stored energy, not more than about 148 pounds are utilized. Again Mr. Leavitt's ingenuity has supplied a remedy. Instead of heating the air within the flask during the entire run of the torpedo as he first did, he, too, heats the impulse supply *outside* and between the reducing valve and the turbine, but, in order to make use of more of the stored air than possible heretofore, he causes the ignition of an alcohol flame inside of the flask toward the latter part of the run. By this means he is able to use to good effect 174 pounds of the original 191 pounds of the compressed air, thus increasing the range and the maintenance of higher speeds throughout the longer run.

Without giving away state secrets, the following table will show what the superheater has made possible in the case of an 18-inch torpedo. These figures are very instructive:

Speed in Knots.	Air Unheated	Air Heated.
At 1,000 yards.........	35	43
At 1,500 yards.........	30	40
At 2,000 yards..	28.25	38
At 3,000 yards.........	23-24	32
At 4,000 yards.........	18-20	28

The next stage in the development was the production of a 21-inch torpedo, in which the range and speed was increased.

We are not at liberty to give details of this weapon; but it may be stated that the English extreme range of 10,000 yards is probably equalled both in our own 21-inch torpedo and in the latest German type of approximately the same size.

War the Destroyer

(Concluded from page 375.)

to a strange paradox. Under certain conditions a company of good shots may be less effective than one composed of inferior marksmen. This is illustrated by the accompanying diagram. Two different groups of men are supposed to be shooting at a company of soldiers arranged in three ranks.

The first group has a rather inaccurate aim, and its *beaten zone*, i. e., the ground over which the impacts of their bullets spread, is long and broad, extending over all three ranks and beyond. Another company, good marksmen, but misled by an incorrect estimate of the range, send their bullets to a much more restricted zone, which fails entirely to reach any of the men of the front rank. It may be remarked here that the error made in estimating range by eye at from 600 to 1,200 yards distance is about 12 to 15 per cent, according to the extent of training. Instrumental range finders are correct to within about 5 per cent, which is about the same as the accuracy attainable by taking the mean of several expert estimates by eye.

The effectiveness of rifle-fire depends not only on accuracy of range, but also upon the rapidity of firing. This varies somewhat with the distance of the target, since a little longer time is required to take an aim at a difficultly discernible object. As an average figure it may be assumed that at a distance from 200 to 400 yards 10 shots per minute can be fired. At 500 to 700 yards this is reduced to 7.5 shots per



In one case Rice's brought 50% more daylight

It was in the plant of the Kellogg Toasted Corn Flakes Co. (See what they say below.) Over 3,000 firms have had similar experiences—concerns like the Ford Motor Car Co., General Electric Co., etc.

More daylight means more dividends. Employees work better, when they can see better. In one big mill, the cost of production rose 20%, when artificial light had to be used.

Rice's Gloss Mill-White not only increases daylight; it is also the most sanitary interior finish, for it can be washed with soap and water. Another convenience: *it can be applied over old cold-water paint.* It also saves money by making *repainting less frequent.* And it will not flake or scale.

RICE'S GLOSS MILL-WHITE

is the original "mill-white." All others are imitations. They may *appear* as well when *first* put on, but at the end of six months, not one will have remained as white as Rice's.

Guaranteed to Remain White Longest

Rice's is the *only* gloss paint which contains no varnish. It is made by a special process, discovered and owned exclusively by us.

We *guarantee* that if Rice's does not remain white longer than any other gloss paint—applied at the same time and under the same conditions—we will give, free, enough Rice's to repaint the job with one coat. We also guarantee that, properly applied, Rice's will not flake or scale. You cannot lose, under this guarantee.

Sold direct from factory

Rice's Mill-White is sold direct from the factory in barrels containing sufficient paint to cover 20,000 square feet—one coat.

Send for sample board, and booklet, "More Light"

On Concrete Surfaces

On inside concrete, Rice's Granolith makes the best possible primer for a second coat of Rice's Gloss Mill-White,—giving a tile-like enamel finish at no more expense than lead and oil paint.

U. S. GUTTA PERCHA PAINT CO.
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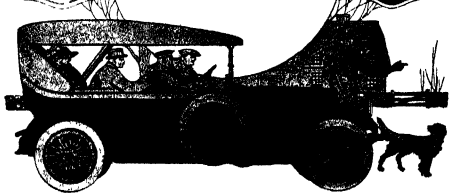
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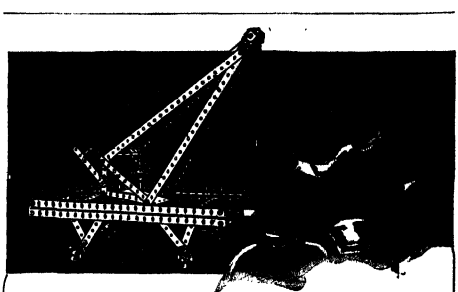
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Terrible as are the ravages of war, they are far surpassed by some other disasters, which from time to time overwhelm the human race. The Franco-Prussian war killed about 180,000 in seven months. The death roll of the Russo-Japanese reached about 200,000. A single earthquake (1737 in India) has been estimated to have caused 300,000 deaths. The fatalities of the Messina earthquake in 1908 cannot have been far short of 100,000. A tidal wave in 1896 drowned 27,000 persons in Japan, causing a greater loss of life than the whole war with China in 1894. The earthquake in Japan in 1703 is said to have killed 200,000 people. The Lisbon earthquake in 1755 destroyed 50,000 human lives, while 40,000 were lost in the same year in earthquakes in Persia.

Terrible as such disasters are, they pass over the multitudes of the human population of our globe as the merest ripples on a mighty sea. The total population of the earth is somewhere about 1,800 millions. Annually there are added to it 14 million souls. Every year at least 60 millions are born, and 60 or 70 millions die. This means a daily birth rate of about 220,000, a death rate of 180,000. The daily increase in population is 40,000. In comparison with this irresistibly swelling tide, what are the greatest battles, wars or earthquakes, but almost microscopic ripples? If we imagine that the power were given to some despot to order a wholesale slaughter, and that guillotines were kept busy beheading one man every minute, night and day, this would add only three quarters of one per cent to the existing death rate!

Compared with the constant and regular causes of death, too, war and catastrophes of nature sink into insignificance. In British India, with a population of 300 millions, 700,000 people die each year of the plague. The infant mortality is responsible for some 3 or 4 million deaths annually in Europe alone, probably for some 25 millions all the world over. If this mortality could be reduced four per cent, one million lives would be saved every year. It is estimated that the decline in the birth rate in Germany since 1906 has reduced the number of annual births by about 180,000. Were it not for a more than compensating diminution in the death rate, the effect of this decline on the population would exceed in a single year the influence of the destruction of Messina. The total number of suicides in Europe alone is from 60,000 to 70,000. Every summer in which the temperature rises above its usual range kills hundreds of thousands of infants in excess of the normal rate. And so on, instances might be multiplied almost indefinitely. The human race is insured with almost infinite security against destruction. A numerical example may serve to illustrate this.

Given ten newborn males, the question may be asked, what are the probabilities that they will all die before reaching the age of reproduction, say 21?

The probability that one individual will reach age 21, is according to life tables, about 0.7, and the probability that he will die before reaching this age is accordingly 1 — 0.7 or 0.3.

The probability that not one of ten infants will reach the age 21 is, according to well-known principles of the theory of probabilities, the tenth power of 0.3, or $(0.3)^{10}$. This figures out to be about 6 in one million.

If instead of ten males we consider 100, the corresponding probability is expressed as about 4 in 2×10^{52}. The last number, if written out in full, would be a 1 followed by fifty-two ciphers.

This gives some idea of how effectively our race is protected against annihilation

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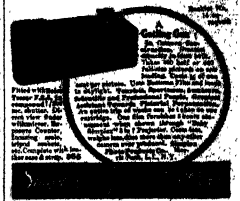
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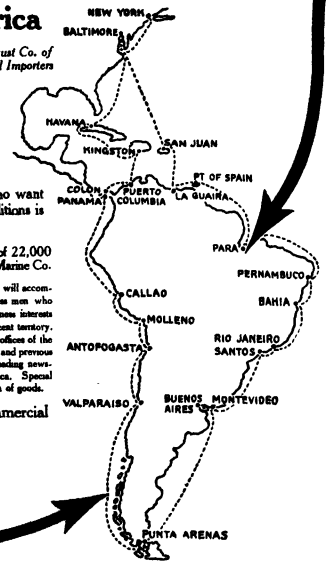


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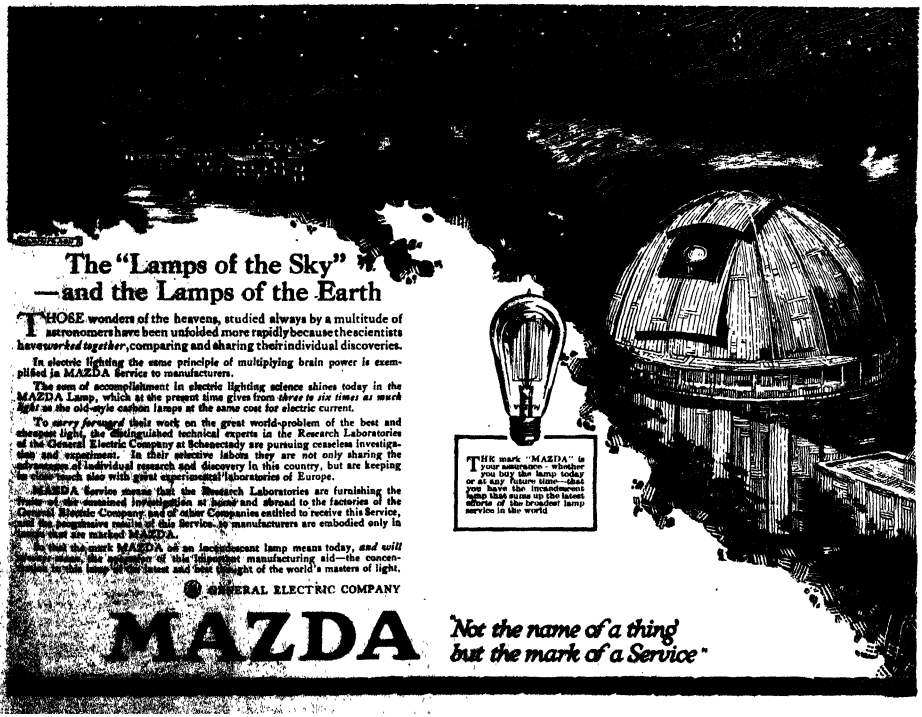
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by war or any other ordinary or extraordinary cause.

Medical Science in the Service of War

(Concluded from page 383.)

conquered, namely, by means of anti-typhoid vaccination and the education of troops to realise the value of cleanliness. The disease is caused by a microbe which thrives in the walls of the human intestine. It is transmitted when the excreta of the infected person comes into contact with water or food which is afterward consumed by other individuals. In camp the immediate disposal of waste is most important. Flies crawling over exposed excreta, and afterward walking over food in the camp kitchen are a sure means of spreading typhoid fever. Other means of spreading it throughout a camp are through personal contact, such as a man whose hands have become contaminated, subsequently handing food or passing a cigar or cigarette to a comrade, passing a pipe from one mouth to another, tracking germs in on shoes, etc. A common method of spreading typhoid fever is now known to be what are called "bacillus carriers." These are persons who continue to harbor and discharge typhoid bacilli even years after they have convalesced from the disease.

As a rule an attack of typhoid fever renders the subject immune to another attack. After a patient has recovered from the fever certain substances will be found in the blood which are known as anti-bodies. These bodies appear to be protective, and their presence renders the person immune to another attack of the disease. These protective substances can be produced by "vaccinating" a person with *dead* typhoid bacilli, and this, of course, is a distinct advantage, for while about 3 or 4 out of every 100 who have recovered naturally from typhoid fever, continue to breed and spread the germs, no such condition is possible after vaccination with dead bacilli. Hence vaccination is of the utmost value, especially among troops where one bacillus carrier, because of his ignorance of his condition, may do the greatest harm.

The English were the first to vaccinate their soldiers. This was largely due to the investigations of Sir Almroth Wright. He killed typhoid bacilli by subjecting them to heat, and then tested their effect on animals. He found that the dead typhoid bacilli produced in the blood of the guinea pig substances similar to the anti-bodies produced in the human blood by an attack of typhoid fever. The British fleet used this new vaccine on the soldiers going to the Boer War. In this instance the soldiers only received one dose, and this, we now know, was not sufficient to produce the desired results. The dose has been increased to three doses administered at intervals of ten days.

Test of Typhoid Vaccination.

In India in 1908 the British vaccinated 6,000 soldiers against typhoid fever, and compared them with a like number not vaccinated. The result of this test was a triumph for the vaccination, for it showed that seven times as many non-vaccinated soldiers contracted typhoid fever, and eleven times as many died. In fact, it was found that the same number of the non-vaccinated died as were taken sick among the vaccinated. Of the number who were vaccinated yet contracted typhoid fever, only four received more than one dose. These four developed very mild cases.

The British and German armies have reported considerable success with anti-typhoid vaccination. The Germans cut the typhoid rate in half during the campaign against the Herreros in Southwest Africa during 1904-07 by the use of the vaccine.

In 1911 vaccination against typhoid was made compulsory for all men in the United States Army under 45 years of age who had not had the disease. The Navy then adopted the same measure, and now both services are believed to be immune. As proof of the immunity, we may take the typhoid figures of a division which was in Florida in 1898, and one which was in



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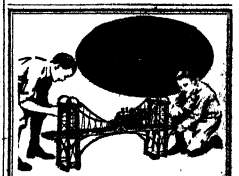
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Texas during the border troubles in 1911. Climate, season, and general conditions were similar. In 1908 there were 2,606 cases of typhoid fever and 248 deaths among 10,759 men; in 1911 there were 2 cases and no deaths among 12,801 men.

While tetanus does not seem to have been the cause of a very high percentage of deaths during other wars, Austria has recognized that it is a factor to be reckoned with. During August that country ordered fifty liters of anti-tetanus serum from the Department of Health of the city of New York.

In the Russo-Japanese war lockjaw infection was more prevalent during the winter campaign than in the summer. This was accounted for by prolonged housing in earth huts, and the proximity of horse manure. In order to avoid tetanus it is necessary to prohibit the men from going about in their bare feet, and to see that wounds are protected against contact with earth, and especially horse manure.

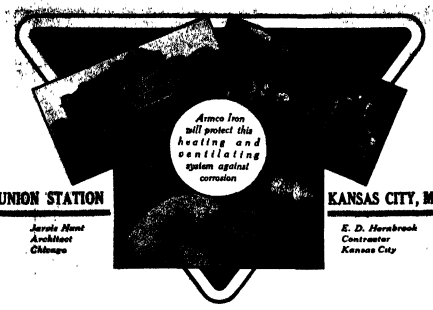
Other diseases to which troops are subject are dysentery, malaria, measles, smallpox, and plague. Measures for the prevention of dysentery are the same as those for typhoid fever, but experiences with vaccines are still too limited to permit any judgment as to their value. The germ of malaria was discovered in 1880 by Laveran, a French army surgeon. The germ is transmitted by a bite of a female anopheles mosquito. After biting a man suffering with malaria and drawing into her stomach the germs of the disease with the blood, the germs developed with the mosquito are injected into the next person she bites. The methods of preventing malaria are the destruction of the breeding places of the mosquitoes, the use of nets and bars to prevent their biting, and the administration of quinine when troops are in a locality where the anopheles mosquitoes abound. In the Union army in the civil war there were 76,000 cases of measles and 5,000 deaths. The only way of preventing the spread of this disease is by isolating the patients. In fact, in an encamped army the first thing which should be done to a sick man is to immediately isolate him. Small-pox has yielded to vaccination. Bubonic plague is caused by a germ which is generally transmitted to human being through the rat flea. Rats are susceptible to the disease, and when they die the fleas are prone to attach themselves to man. Rats should be relentlessly exterminated. Prairie dogs and the ground squirrels of Manchuria are also subject to plague.

Sterilized Water Insures Health.

The most important factor toward maintaining health in a camp is pure water. There are many ways of accomplishing the purification of water. One of the newest and most interesting is by the use of ultra-violet rays, which have marked destructive action on any disease germs which may be present in the water. Water which has been subjected to ultra-violet radiations is rendered sterile without affecting its taste or odor. For field use a steriliser with a capacity of 150 gallons an hour can be carried on an ordinary gun carriage. The equipment consists of a steriliser, a gasoline motor for generating electricity, a hose fifteen to twenty feet long to connect the pump with the water supply, and a tripod on which the steriliser is mounted. The apparatus will deliver sterile water in 5 minutes from the time the motor is started.

The Austrian army is using such an equipment with success. The French used it in Morocco and found that the perfectly sterile water which they obtained was of the greatest value in their military hospital at Oudja. In all the cases of wounds which were washed with water sterilized by the ultra-violet rays they did not have a single case of infection. Among the troops using it entirely for drinking purposes no cases of intestinal disease were observed.

Other methods of purifying water are sedimentation, precipitation and filtration. In sedimentation the water is held in reservoirs that the suspended solids may sink. The clear water is then piped off from the top. Of course this method does not kill bacteria. Precipitation is accomplished by



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Resists Rust

THAT is why it is used for the ventilating system of this new Railway Terminal. ARMCO, American Ingot Iron, was subjected to severe tests to prove that it would withstand such conditions as a ventilating system imposes. As a result 300,000 pounds of galvanized ARMCO iron were ordered for this building—the largest contract of its kind in the West.

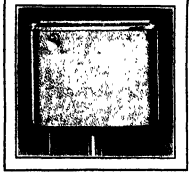
ARMCO, American Ingot Iron, is unequalled not only in purity, but also in the care given to every process of its manufacture. This also accounts for uniformity of quality and resistance to Rust.

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The Enameled Tank Company of Kalamazoo, Michigan has adopted ARMCO Iron for enameled tanks in spite of its higher cost, because of its superior durability, welding qualities and unequaled enameling properties. Enamel on a base of ARMCO Iron does not show pin holes and imperfections, because of the even texture of and freedom from gas bubbles in the iron. ARMCO Iron has already been adopted very largely by makers of refrigerators, stoves and other enameled products for the same reason.

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for nearly all metals, including such difficult ones as cast iron and aluminium, have been the subjects of hundreds of paragraphs in the Scientific American Supplement. We quote a few of the more important articles, as follows:

Scientific American Supplement No. 1673—*Full instruction for Mending or Welding Cast Iron*, gives both brazing solders and fluxes necessary.

Scientific American Supplement No. 1713—*Brazing Cast Iron and Other Metals*, gives detailed instructions for the whole operation and formulas.

Scientific American Supplement No. 1644—*Soldering and Soldering Processes*, gives broad general information, and contains in particular a method for pulverizing solders and alloys of great use.

Scientific American Supplement No. 1667—*Some Soldering Appliances*, describes the blow-pipe and the furnace in their various forms.

Scientific American Supplement Nos. 1610, 1622, 1628 contains a series of three articles on Solders, covering the entire range of solders for all metals. No. 1628 contains formulas and instructions for *soldering aluminium*.

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which entangles floating particles, even bacteria and causes them to sink. There are several methods of filtration, but except for more or less permanent camps, none are ordinarily used in armies.

Water may be purified by chemical means, but this generally causes a certain amount of unpleasant taste and odor. It has the advantage, however, of rapidity and simplicity. Where vegetable growths abound one part of copper sulphate to a million parts of water will be found satisfactory. Maj. Darnell of the Medical Corps, U. S. A., has devised an apparatus which destroys bacteria in water by means of chlorine gas. This is an economical method costing about 40 cents per million gallons of water.

Ozone, the allotropic modification of oxygen, is also an efficient destroyer of bacteria. For actual field use there have been designed apparatus for use of chlorine, ozone, and the ultra-violet ray. The Japanese used the Ishiji filter in the field during their war with Russia.

The science of warfare and the science of medicine have advanced side by side. The men who are killed outright on the field of battle are beyond the surgeon's aid, but never before in any of the world's wars have as great a percentage of the wounded recovered as will recover in the war which is changing the map of Europe. Science must mend what brutality wrecks. The law of compensation is still in force.

An Army on the March

(*Concluded from page 386.*)

upon parallel roads, the separate lines of advance keeping in close touch with each other to maintain cohesion and insure a properly co-ordinated arrival on the battle field.

The accompanying diagram of a division on the march is so clearly drawn and fully lettered, that it calls for no detailed description. The order of march is determined, first, by tactical considerations, which, in the presence of the enemy, are of prime importance; and second, by the general principle that the hardships of the troops must be reduced to a minimum. The column is preceded by a strong body of cavalry, who locate and determine the strength of the enemy, and are generally about three miles in advance of the "point" (see diagram) or head of the main body. Also, a detachment of engineers usually marches near the head of the main column, to repair roads, strengthen bridges, etc.

On the march the troops usually keep to the right of the road. On muddy, sandy, or very dusty roads the column divides longitudinally, thereby making it easier for men and animals to pick their way, the middle of the road being clear.

As far as possible, marches begin in the morning; and, as a rule, foot soldiers do not start before broad daylight, and mounted troops an hour after broad daylight.

The rate of march is regulated by the foot troops. It varies according to the length of the march, size of the body of troops, their condition, and other circumstances. The rate is reduced by sandy, rough, muddy, or slippery roads, great heat and dust, strong head winds, storms, and swampy, hilly or broken country.

For infantry the maximum rate is 3 miles an hour, or, including halts, 2½ to 2¾ miles. Under average conditions the rate of infantry columns is 2¼ to 2½ miles an hour. For large bodies of troops the rate is about 12 miles a day; but small bodies of seasoned troops marching on good roads in cool weather are considered by our army men to be capable of 20 miles per day, though on forced marches this, of course, has been greatly exceeded.

The average march of cavalry, when men and horses are seasoned, is about 25 miles a day.

The daily march of field artillery is about the same as that of the command of which it forms a part. Alone it can cover from 15 to 20 miles.

The daily march of a wagon train is



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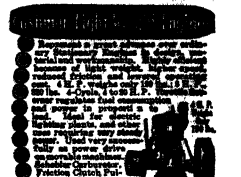
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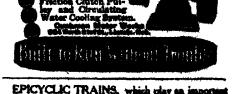
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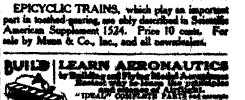
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about the same as that of the infantry.

To rest the men and animals, and for other purposes, a command on the march is occasionally halted. The first halt is made after marching about three quarters of an hour, and is about fifteen minutes long. After the first rest, there is for foot troops a halt of about ten minutes every hour. The men are allowed to fall out, but in the vicinity of their places only. For cavalry the halts are for five minutes only, and for artillery for five to ten minutes.

When contact with the enemy is probable, the columns are closed up and march on broad fronts; communication is maintained between the columns on parallel roads, and all baggage not needed in the conflict is kept in the rear.

Military trains, etc., are at all times provided with the necessary guards, and in marches into action the trains are held far enough in the rear not to interfere with the movements of troops or check withdrawal in case of defeat.

In retreat, the order of march shown in our diagram is reversed.

Failure of the Military Aeroplane Competition

BECAUSE the eleven entrants in the competition for military tractor biplanes failed to file the necessary plans, specifications, and data required under the rules, Major S. L. Reber, the commanding officer in charge of aviation, called off the competition on the 22nd instant, although three machines of well known makers were on hand. These constructors evidently believed that if they produced and flew machines able to fulfill the requirements of the competition, a strict adherence to the rules in the matter of stress charts, angles of glide, and the like would be insisted upon. In this they were mistaken, those in charge evidently deciding that if the engineers of the various constructors were only able to work by rule of thumb, and were incompetent to give the information and drawings demanded, the Army does not want their aeroplanes, no matter how creditably they perform. Then, too, it would not be fair to those contestants who had filed plans but were unable to get their machines to San Diego by October 20th. A re-opening of the competition several months hence will probably be decided upon. In the meantime, if the Army needs up-to-date machines for its few aviators, these can be bought from the constructors.

This competition for tractor biplanes was based on what the best foreign machines have accomplished. Besides a pilot and passenger, each of 150 pounds weight, the aeroplanes were obliged to carry oil and fuel sufficient for a four-hour flight, as well as 450 pounds of deadweight, in all the tests. Construction and workmanship; speed, maximum and minimum; climbing and maneuvering ability; ease of handling; gliding angle; inherent stability; suitability of landing gear, including length of run on the ground in starting and landing; and field of vision, were all to be taken into account in judging the machines. The three best were to have been purchased for $12,000, $10,000, and $8,000, respectively. It was considered doubtful by army aviators if any of the machines could fulfill the climbing test of 4,000 feet in ten minutes when fully loaded One well-known constructor believed that an aeroplane fitted with a 100 horsepower revolving-cylinder motor would be the only one capable of executing the climbing test. All three machines that put in an appearance were fitted with water-cooled motors of the 8-cylinder V type—a type that has now been adopted by one of the leading automobile firms for their cars. One, which has a motor developing 85 horse-power, flew with a speed variation of 45 miles per hour, and afterwards, piloted by Lieut. H. L. Muller, increased the American height record by 2,308 feet, reaching 17,440 feet elevation. The maximum speed of this machine was 86 miles per hour. One of the remaining two machines, each of which was equipped with 100 horse-power motors, flew the 120 miles from San Diego to Los Angeles, with three aboard, on September 30th.

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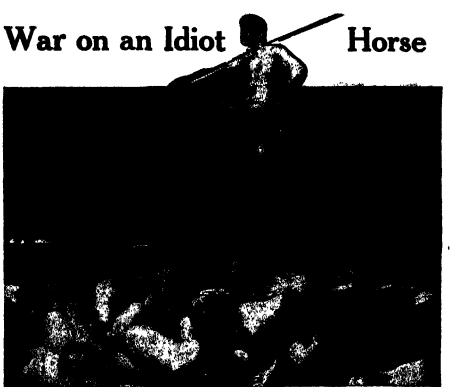
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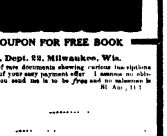
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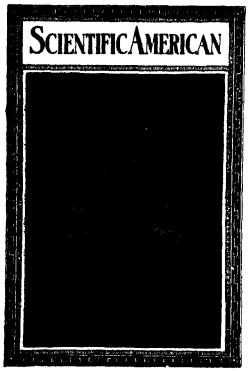
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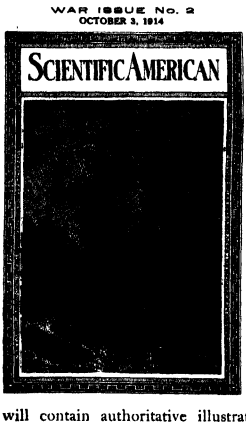
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WAR Issue No. 1 of the Scientific American, published September 5th, is an authoritative handbook of the Great European War, giving exact and detailed information concerning the Armies of all the countries engaged, their comparative strength, armament, signal and telegraph service, medical and ambulance service, etc.

WAR ISSUE No. 1
SEPTEMBER 5, 1914



WAR ISSUE No. 2
OCTOBER 3, 1914



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RECENTLY PATENTED INVENTIONS

(*Concluded from page 389.*)

an alloy. These advantages are especially important in the latter case.

PLUME DRYING APPARATUS.—H. METHOT, 29 W. 84th St., New York, N. Y. In this machine the drying of the plumes is accomplished by the combined action of a blast of heated air directed in the feathers, and of a beater which mechanically agitates the feather to dislodge the particles of moisture and starch therefrom.

CONVEYER.—W. J. TURNBULL, deceased. Address H. W. Hillis, Room 806, Wells, Fargo Bldg., New Orleans, La. An object here is to provide a device by means of which a vessel or other similar carrier may be unloaded in a minimum time and at a minimum cost. Another object is to provide a movable conveyer which may be elevated or lowered to accommodate the heights of different vessels.

SLAT CONVEYER.—W. J. TURNBULL, deceased. Address H. W. Hills, Room 806 Wells Fargo Bldg., New Orleans, La. An object in this case is to provide a conveyer which is of the endless type, but the conveying surface of which is so fashioned as to present a substantially continuous flat surface, thereby preventing loss of material conveyed, while at the same time being capable of passing around the driving wheels at the end of the conveyer.

WASHING MACHINE.—L. YOUNG, care of Andrew Ferrara, 620 Center St., N. Bergen, N. J. This invention relates to washing machines adapted especially for extensive laundry operations. Means provide for the preservation of delicate fabrics by preventing direct wear thereon, and to permit of sufficient clearance for buttons, hooks and the like, on garments being washed, to prevent their being torn out of the garments. The machines may be constructed of substantially uniform or standard size and may be fitted into tubs of varying sizes by cutting off more or less of projections according to each individual tub.

Medical Instruments.

SPECULUM.—F. E. P'POOL, R. F. D., No. 7, Brenham, TEX. This invention provides a yielding device for dilating the orifices of the body under certain conditions; provides a device which will retain its position in the orifice in which it is inserted, and provides a device with means for holding a cleansing material.

Railways and Their Accessories.

CAR GEAR EQUIPMENT.—C. H. BISHOP, 105 N. McComb Ave., El Reno, Okla. This inventor provides mechanism for connection with the body of a railroad car, for causing the brakes to be applied when pressure is exerted on the couplings of the car, wherein draw or coupling bars are provided, mounted to slide on the car body, each of the said bars bearing at its outer end a coupling head, and having mechanism for engaging the brake mechanism of the adjacent truck for applying the brakes, when the coupling bar is moved inward, and wherein spring mechanism provides for normally pressing the coupling bars outward.

RAILWAY SYSTEM.—F. CASTANHO, Rua Paulista 39, Sao Paulo, Brazil. This system may be embodied in the form of amusement apparatus, or in a railway for general purposes. It is the design of the inventor to provide a railway car and tracks controlled and arranged to promote safety in guarding against derailment of the car.

AUTOMATIC TRAIN STOP.—A. MASTRANGELO, 106 Point Ave., Weehawken, N. J. The purpose of the invention is to provide an inexpensive device with which a modern locomotive can be easily equipped, which will in no way interfere with the normal operation of the locomotive, and which is always in operative position.

Pertaining to Recreation.

REGISTER.—A. W. KEMPNER, care of Oppenheimer & Co., 96 Pearl St., New York, N. Y. This invention has special reference to improvement in registers, and more particularly to a device which may be termed a golfometer, for keeping a count of the number of strokes for each hole and the grand total of strokes for the entire course in playing golf, and also for determining which golf hole is being played.

DOLL BED FRAME.—W. A. RENDICK, Niles, Mich. The invention provides a rocker attachment for the wire frames of doll-beds which are simple and inexpensive in construction and adapted to be easily applied to the legs or posts of the frames for converting the same into rockers if desired.

MECHANICAL ROWBOAT.—R. E. C. WEIS, 287 Baldwin Ave., South Ozone Park, Woodhaven, L. I., N. Y. In this boat, a dummy, in the representation of a person, is pivotally supported and adapted to be oscillated by a connection with a spring or other motor, mounted on the hull near the stern, or otherwise, while the dummy consists of an arrangement of pivotally connected parts to permit a natural movement as in the act of rowing, there being oars attached to the arms of the dummy to cause propulsion of the boat.

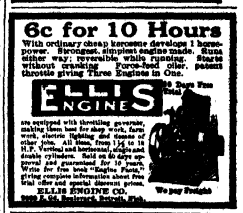
Pertaining to Vehicles.

VEHICLE CURTAIN.—C. S. APPLAS, care of Applas Mfg. Co., 922 Fifth Ave., Moline, Ill. This invention provides a manner of arrangement of automobile or other vehicle curtains, including a manner and means of convenient and easy stowage of the curtains when the same

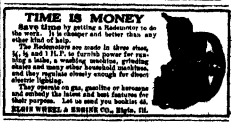
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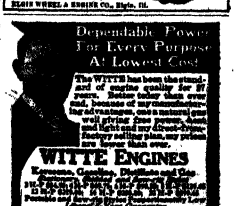
ENGINES











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How a small and simple experimental installation can be set up at home. Scientific American Supplement 1554. Price 10c cents. For sale by Munn & Co., Inc., and all newsdealers.

are not in use, and means for quickly and easily swinging the curtains into position for service, and means for holding them in that position.

SHOCK ABSORBER.—H. A. AHNERT, 170 W. 89th St., Manhattan, N. Y., N. Y. The invention has reference to springs or cushioning devices for vehicles and has particular reference to means for relieving a motor vehicle especially from the objectionable bouncing due to rapid travel over rough or uneven roadways.

AUTO DRIVE.—A. O THESEN, 935 Twigg St., Tampa, Fla. This drive is especially adapted for heavy trucks and the like, wherein a separate support is provided for the motor and the operating mechanism, the support being connected to the front axle, and having steering mechanism connected therewith, to move the same whereby to guide the vehicle, and wherein the motor is connected with the four wheels, to directly drive the same.

CLIP.—D B JACOBS, Apt. 402, 4280 Broadway, New York, N. Y. This clip is more especially designed for use in swingletrees, doubletrees and similar devices, and arranged to permit of quickly and securely attaching the clip without requiring the services of a skilled mechanic, to securely hold the trace holder or the supporting link in position, and to allow of conveniently disassembling the parts for removal and replacement of a worn out part.

PAWL AND RATCHET FOR DUMPING BOXES.—H. F. ROTH, care of Crown Mfg Co., Sturgis, Mich. The box is adapted to be applied to the running gear of an ordinary wagon, and wherein mechanism is provided for permitting the bottom of the box to be opened into dumping position throughout the entire width of the box, and throughout the entire length between the axles of the running gear to insure the dumping of the contents of the box, and wherein the dumping mechanism is so arranged that the weight of the material dumped insures proper operation of the same

BUGGY SHAFT SUPPORT.—B. M PERDUE, Franklin, Ky The invention is an improvement in that class of devices which are applied to horse drawn vehicles for the purpose of supporting the shafts in elevated position when the vehicle is not in use It is more particularly an improvement upon that for which Perdue received Letters Patent of the U S No. 1,050,087.

SECTIONAL MUD GUARD FOR MOTOR CYCLES.—H. L. RODERICK, Oroville, Cal. The invention has reference to an improved sectional mud guard for motorcycles, the device being designed to facilitate the removing and replacing of the rear wheel, such as for purposes of repair of the wheel or tire or for putting on a new tire.

Designs.

DESIGN FOR A GAS SAVING ATTACHMENT FOR GAS STOVES.—C. HUBER Room 1321, 47 W 42nd St., New York, N. Y. In this ornamental design for a gas saving attachment for a gas stove, the attachment is shown in two views, one perspective and the other sectional.

DESIGN FOR A SANITARY TOOTH CLEANER.—E. G. OVER, care of Libby, McNeill & Libby, Fort Worth, Tex. In this ornamental design for a sanitary tooth cleaner, the device is shown in a plan view of the full side; a plan view of the back of the device, and an enlarged edge view of the device.

DESIGN FOR A SHEET METAL STOVE BODY.—E. C. COLE, care of Cole Mfg Co., 3218 3238 So. Western Ave., Chicago, Ill. In this ornamental design for a sheet metal stove body, the first view is an end representation of the stove body showing the new design; the second is a plan view of the same; and the third is a side view.

DESIGN FOR A HORN.—E. KAUFMANN, 110 W. 40th St., New York, N. Y In this ornamental design for a horn, the tube of the instrument from the mouthpiece to the wide flanged open end extends and bends in grace ful lines, the upper and lower sections being supported by two miniature harps

DESIGN FOR A BADGE.—D. M BRADY, 95 Liberty St., New York, N. Y In this ornamental design the badge is circular, the inner part comprising a baseball to which wings are attached at one side.

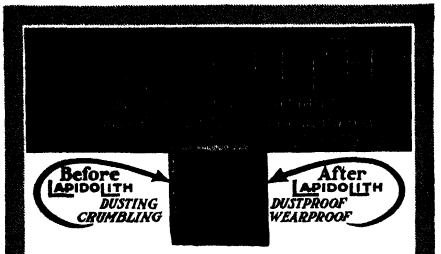
NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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IDA M. TARBELL ON BUSINESS

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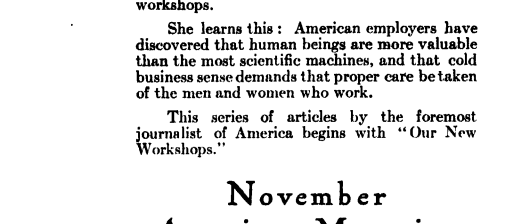
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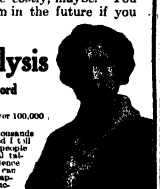
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HENDRICKS'S COMMERCIAL REGISTER OF THE UNITED STATES. For Buyers and Sellers. New York: S. E. Hendricks & Co., Inc., 1914. 4to.; 1,586 pp. Price, $10.

The Register is a bulky volume of compact information whose index alone occupies 182 pages. It would be hard to find an article of commerce or industry, from canned goods to portable houses, that is not listed. In any classification which carries a large number of names, as, for example, "architects" and "boilermakers," these names are segregated under their native States, so that reference to particular sections of the country is greatly facilitated. The work includes some 250,000 names and addresses, with 55,000 business classifications. To any whose business interests are connected directly or indirectly with such industries as contracting, engineering, hardware, iron, mill, mining, and railroading, the Register offers a fund of accurate information that is of prime importance both to buyer and seller. Six copies are in constant use in the SCIENTIFIC AMERICAN office, which is a sufficient indication of its value.

THE MAHIN ADVERTISING DATA BOOK. 1913-1914. Facts and Statistics in Condensed Form for the Man who has Advertising and Merchandising Problems to Solve. Chicago: A. C. McClurg & Co. Price, $2.

Perhaps the chief feature of this invaluable little pocket book is the list of towns in the United States and Canada, listed alphabetically by States, and giving population, location, advertising mediums and rates. The population of each State, the number of street cars and the population they serve, and full and half-run rates for street car campaign, are also noted. There are some admirable little articles on advertising practice and principles, and a discussion of types, with illustrations of those most in use. Another eminently useful compilation is that of the leading magazines, trade journals, and religious publications of the country, with their circulation, dates for closing of forms, the size of page and width of column, and their advertising rates and discounts. Advertisers and salesmen will, by keeping these data at hand for constant reference, save much time and increase efficiency. The ten tests applied in judgment of advertising value may not be passed by without a word of appreciation.

MECHANICAL PROPERTIES OF WOOD. Including a Discussion of the Factors Affecting the Mechanical Properties and Methods of Timber Testing. By Samuel J. Record, Assistant Professor of Forest Products, Yale University. New York: John Wiley & Sons, 1914. 8vo.; xi+165 pp.; 51 text figures and half-tone plates. Price, $1.75.

This is a book intended primarily for the use of the student in forestry. Also, the book may well serve as a guide for the mechanical engineer or wood user who wishes to become more familiar with the properties of wood. After a brief introduction, the work very properly begins with the fundamental considerations and definitions which are all reduced to the simplest terms, and without reference to higher mathematics, with which the students are often unfamiliar. This is followed by 46 pages of description of the factors influencing the mechanical properties of wood. Among these are rate of growth, heartwood and sapwood, weight, color, grain, knots, splits, injuries by borers, fungi, water content, temperature, and preservatives. About 10 pages at the chapter are devoted to a consideration of the general effect of the water content upon wood substance. Following this is a brief discussion of the methods employed in preparing and testing the timber and recording data. The methods recommended are for the most part those followed by the United States Forest Service. The whole book is very systematically arranged and furnishes abundant material for study by everyone who is interested in this important branch of forestry and engineering. There is appended an extensive bibliography made up of books which will be very helpful to those who wish to refer to more complete discussions on certain phases of this subject. Not only are the most familiar books cited, but also a large number of more or less obscure works which are excellent sources for further information. A number of the German and French works given are not readily accessible, however, except to those who are located near large libraries.

MECHANICAL MOVEMENTS, POWERS AND DEVICES. By Gardner D. Hiscox, M.E. New York: The Norman W. Henley Publishing Company, 1914. 8vo.; 406 pp. Price, $2.50.

This volume has been revised a number of times and brought up to date. It contains a large number of valuable mechanical movements and devices, many of which are not found elsewhere. The principal criticism is that the illustrations are diagrammatic in character, some of them being catalogue cuts, and others are taken from various technical publications, including the SCIENTIFIC AMERICAN and the SCIENTIFIC AMERICAN SUPPLEMENT. Perhaps it would have been better had all of the illustrations been reproduced uniform in pure line, preferably by the wax process.

MATHEMATICS FOR FRESHMEN STUDENTS OF ENGINEERING. By Theodore Lindquist. 135 pp. A dissertation submitted to the faculty of Ogden School of Science, Department of Mathematics, University of Chicago.

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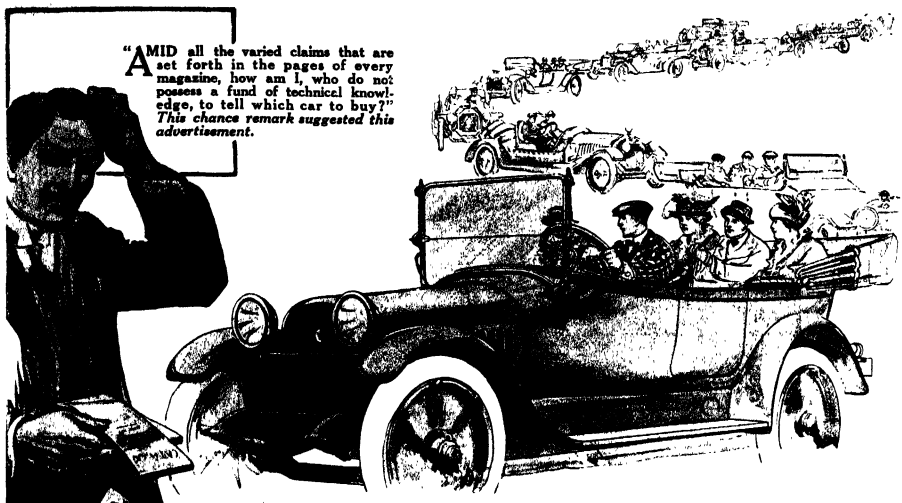


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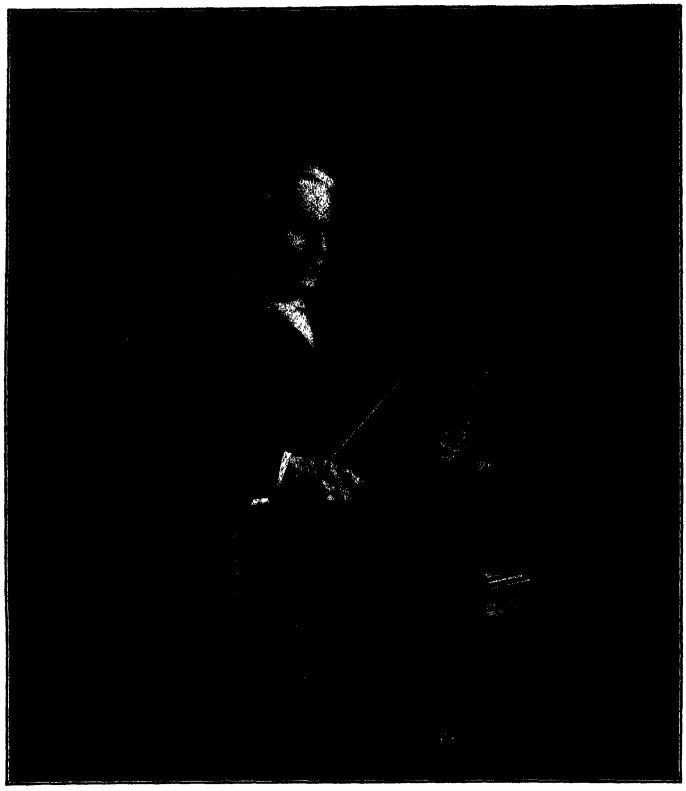
Automobile buyers, in greater number this year than ever before, find in these reasons for buying a Chalmers "Six" the best answer to the question, "How Am I to Tell Which Car to Buy?" Our shipments thus far this season exceed those of the same period of 1914, which was the biggest Chalmers year. The satisfactory answer in the 1915 Chalmers "Sixes" to the question above has made these our fastest selling cars—**The Most Successful Cars of Seven Successful Seasons.**

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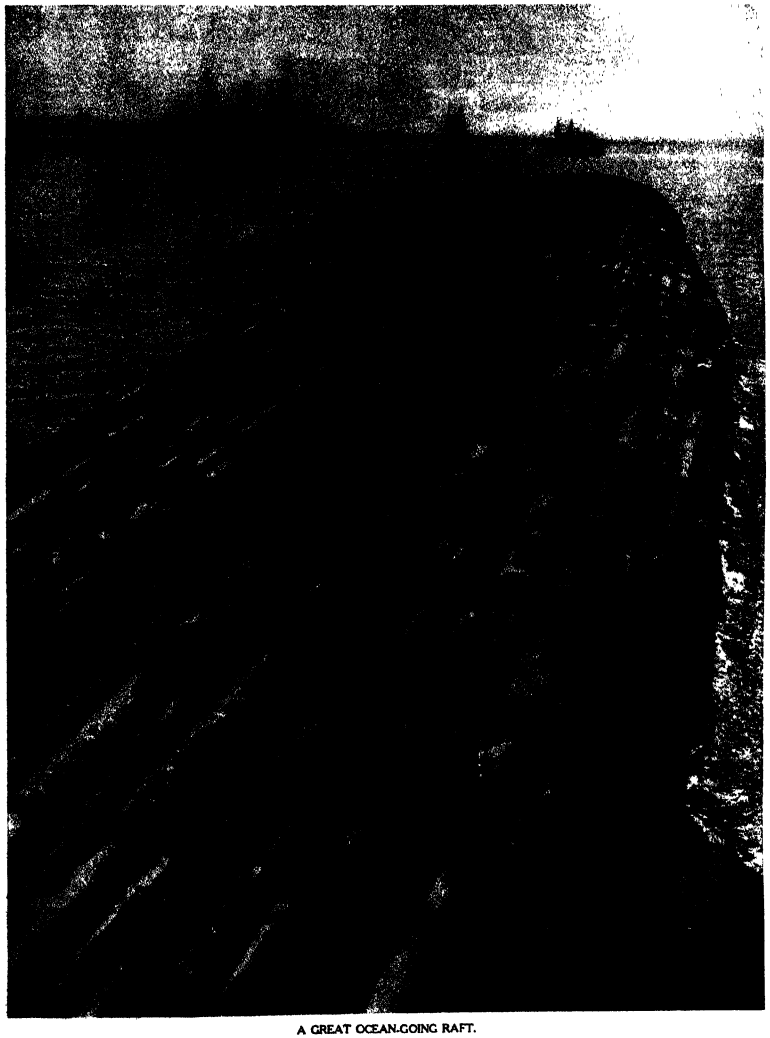
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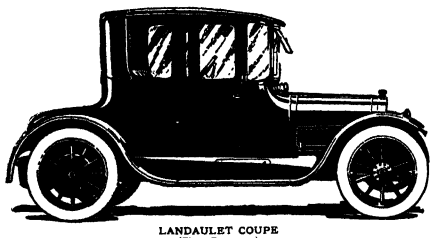


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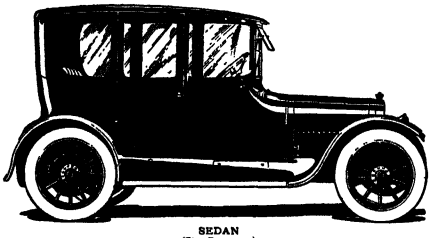
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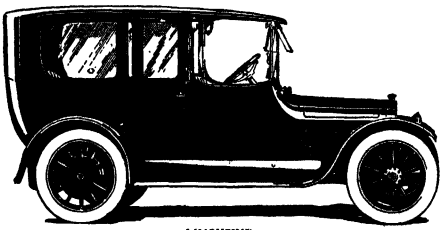
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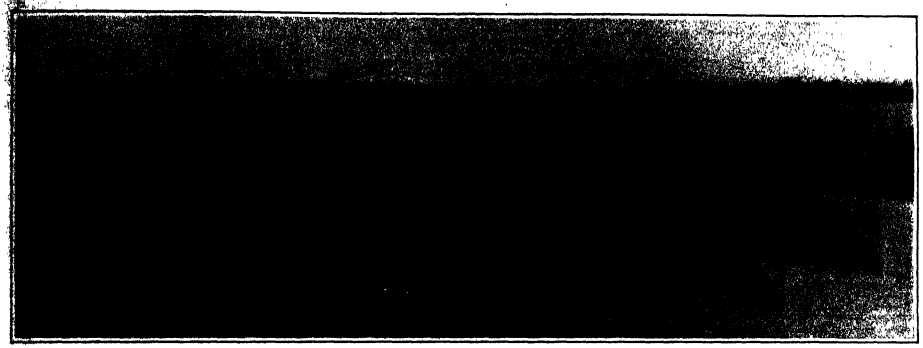
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Three great ocean-going lumber rafts in San Diego harbor.

Ocean-going Log Rafts

By J. F. Springer

ONE of the large industrial problems of the times is the transportation of raw material. Such material is often in almost inaccessible situations, and sometimes also far away from the manufacturing point. Thus in the case of timber logs, they will often be cut far up on the mountain side, or in a swamp or exceedingly distant from the sawmill. A partial solution of the problem, but one which fits only some of the cases, is obtained by building the mill in the vicinity of the cutting or in using a portable one. But the demand for lumber fluctuates greatly; so that if cutting is to go on continuously there will be accumulations of boards and other sawed products. Such accumulations involve investments of capital which may be very undesirable. The freight rates by rail and boat are apt to be very considerable, especially where the distance is long.

Impelled, no doubt, by considerations such as these, Capt. H. R. Robertson undertook thirty years ago to construct a raft of logs in Nova Scotia, and then to bring it to New York in care of a towing tug. Apparently, this raft was the first ever constructed with a view to ocean navigation. The general idea of rafting logs was not a new one. But it had only been applied, so far as is known, to cases where the route lay through inland waters. A framework was set up on the shore near Pictou, Nova Scotia, by Capt. Robertson, and by its means a great bundle of logs was constructed. This was the raft, but it was still on the land. After a good deal of difficult work, the unwieldy mass was at last gotten into the water, and the journey toward New York begun. The tug in charge got it out to sea and some distance on the way, when a shortage of coal arose. So the tug went into port for the needed fuel. When this was obtained and the tug got back, the raft was nowhere to be seen. In fact, no one seems to have located it then or afterward, until at last it was discovered on the other side of the Atlantic Ocean on the Norwegian coast. This experience proved that Capt. Robertson's main idea was right; it was possible to handle a lot of logs together in such shape as to make a seaworthy mass. And this was a great deal.

Another thing was shown by this effort. It was inadvisable to build on shore, unless some method of launching could be provided. Capt. Robertson went to the Pacific Coast, and there carried out the idea of constructing the rafts in the water. A floating cradle was signed and used as a guide or holder in forming the raft. At Coos Bay, along the Pacific boundary of Oregon, two rafts were built with floating cradles. But a shoaling bar made difficult or uncertain the getting of the huge floating masses of logs out to sea. So, Capt. Robertson now transferred his operations to Coal Creek. Here rafts are still built and towed out to sea on the [illegible]. They are towed down the coast to San Francisco, a distance on the sea of 500 or 600 miles. The material that is brought to San Francisco in this way consists only of timbers suitable for piles.

Capt. Robertson's ideas seem to have appealed to Mr. S. Benson, a large owner of standing timber in the neighborhood of Wallace Slough; for about 1906, we find him making efforts to employ ocean rafting in order to get his timber to market. At that time, the freight rate to San Diego, California, was about $10 per thousand board feet. This was one incentive. Another consisted in the fact that rafts would enable sales to be made of lower grade material that would otherwise be largely waste. A third incentive lay in the possibility of manufacturing the timber into lumber at San Diego in such manner as to provide for the reasonable demands of the market, and yet not involve tying up a large amount of capital. Mr. Benson's plans have been carried out with success. Twenty-nine ocean-going rafts have successfully been brought into the harbor at San Diego. There has been no loss, no trouble. In most cases, not a single log has worked loose.

The Robertson system as carried out practically for Mr. Benson by Mr. O. J. Evenson is as follows:

Heavy timbers, each 12 by 20 inches in cross-section and 24 feet long, form the uprights of the floating cradle. The cross bar timbers are much lighter, being 6 by 12 inches in section. The bottom of the cradle is constructed in sections that may be pulled apart when the logs have been secured together. During the construction of the raft, the sections are held together by means of a key piece. The logs are floated to the cradle and the raft built up from the bottom. When about half the logs are in place, an enormous chain made from 2½-inch steel is laid along the axis. Seven herring-bone chains connect the center chain with the ends of the raft. The logs employed for the outer part of the raft are those which are the longest and most pliable. The butt ends are put nearer the amidship portion of the raft, and thus assist in giving the whole a cigar taper at either end. Chains are used to encircle the body of the raft and hold it together. The interior is filled up with logs of miscellaneous lengths. The outside logs will be 50 or 60 feet long, and the raft itself will have a length somewhere in the neighborhood of 700 feet. The various herring-bone chains run diagonally to the cigar tapers and are there secured to the encircling chains. The arrangement of chains combined with the general form of the raft and the method of placing the exterior logs results in a secure bundle. The encircling chains will not work toward the ends because of the herring-bone chains. There is a distribution of the pulling effort of the central chains, when the latter is hauled ahead by the towing chain, that makes for security. There is also a certain amount of slackness of the chain arrangement amidships which conduces to a slight response of the raft to the waves. The herring-bone and the encircling chains are made from 1⅛-inch steel. The latter go all the way round, and are placed at intervals of 12 feet. The central chain extends beyond the ends of the raft at either end. Altogether, the chains on a single raft weigh, with attachments, somewhere about 115 tons and have a value in the neighborhood of $10,000. These figures are for a 700-foot raft. They are built even larger. The thickness of a typical raft is about 30 feet, and its breadth amidships, 55 feet or thereabouts. The tapered portions occupy each about 100 feet of the total length. The amount of timber contained in it will run from 4,000,000 to 5,000,000 board feet. It will sink into the water until about one third of its height is above. A 1,200-mile tow into San Diego costs about $1 per 1,000 feet. The cradle may, of course, be used over and over again. Its first cost is about $5,000. To handle the logs that are to go into the raft, a floating derrick or its equivalent is required.

As such a raft is in effect a boat or barge containing a cargo of timber, it is not at all essential that the interior logs should themselves be suitable for the ordinary methods of logging in which the logs are expected to float. All kinds of timber may be put on the inside—heavy logs, semi-refuse, and so on.

That the development of an economical method for the transportation of raw material may result in a large gain widely distributed may be learned from the recent history of San Diego. Prior to the coming of the first raft into the harbor in 1906, lumber was locally sold as high as the prices associated with a $30 base. In a few months, however, the base was down to $17. This reduction applied to the market generally and not simply to the customers of one or two sellers. San Diego has used upward of half a million board feet in the past eight years. Estimating the average saving per 1,000 feet to have been $8, we have a total benefit of $4,000,000 spread over the entire community.

A somewhat similar system is sometimes adopted in the Coastal Plain of the East, where the logs are brought from the point of origin to a log dump on tidal water. A steel cable or heavy chain will be secured by one end to the trestlework of the railway. The other end is carried up to the second story of the dump structure, where it may be let out or drawn in by a winch. A loop will be formed in this way for the reception of logs dropped from the railway. Two such loops form a cradle. In addition, two binding chains are arranged to hang in the water with the loops, one chain with either loop. One end of a binding chain is for the time being secured to the unloading dock, while the other is attached to a small rope which extends outside the cradle. When a complement of logs—from 20 to 30—is in the cradle, the cradle cables are drawn in by the hoisting device with the object of causing the logs to settle together and form a compact bundle. The binding chains will now be recovered by means of the small ropes, and the bundle securely tied up, heavy iron dogs being used to assist this matter.

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

On the Mat

THE aeroplane, the automobile, and the strategic railway, in co-operation with the enormous hosts which comprise modern armies, have resulted in transferring modern battles from the prize ring (if we may be pardoned the phraseology) to the wrestling mat. The armies of to-day are so vast, so wonderfully mobile, and have such intimate and accurate knowledge of each other's intended movements, that the strategy of Napoleon and von Moltke lives only in history and in the military manuals.

Given an army of sufficient numerical strength to maintain an adequately manned and unbroken front between two flanks which are based upon geographical or political positions which cannot be turned or outflanked, and given in each army equal courage, endurance and generalship, and we find conditions of warfare which result in what is practically an *impasse* or stalemate.

Such is the condition on the three hundred mile battle-line in France and Belgium to-day. So great are the combined numbers of the opposing forces, totaling probably some four and a half million men, that the whole three hundred miles, more or less, extending from the English Channel to the Swiss frontier, is held (or could be held if the troops were evenly distributed) by an average of seven thousand men to the mile on each side. Everywhere the troops have so completely "dug themselves in," and the line, as thus held, supported by rapid-fire field guns, machine guns, and heavy siege artillery, is so impregnable, that the fiercest attacks of that wonderful military machine, the German army, delivered, as they have been, with matchless bravery and indomitable persistence, have failed to break through with sufficient force to bring about a decisive result.

In the earlier phases of this stupendous conflict the various military experts, detailed to unravel the complicated strategy and maneuvers of war for the intelligent reading of the layman, made frequent use of the old phraseology of the books, and we heard much about "driving a wedge," "flanking movements," "rolling up the enemy's forces" and "enveloping him with a ring of steel," and about the possibility of a "second and greater Sedan." Yet nothing of the kind has happened.

The theories of strategy and tactics are the same, but the developments in the modern instruments of war and the vast scale on which the conflict is being waged have rendered the successful application of these theories impossible. When the Allies, a few weeks ago, determined to turn the right flank of the German forces, and depleting for the time being the strength of their center and of their southern line, began to move troops to the northwest and brought up reserves for joint action with these troops in a great turning movement, the German aeroplane scouts were able to judge from the movements of the trains, automobiles, and transport the direction of the movement and its magnitude. The German generals, profiting by this aerial reconnaissance, and using the excellent railway service and the vast automobile transit at their command, were able to concentrate sufficient troops on their right flank to meet and stop the turning movement. Conversely, when the Germans concentrated, let us say, at their center, in an effort to break through the allied lines, they found the enemy massed in sufficient strength at the point of contact, either to hold the line intact or, if it were pushed back, to make a heavy counter attack and rob the movement of any definite practical results.

At least under such conditions as exist in the western theater of this gigantic conflict, it must be admitted that the days of Napoleonic strategy are over. The swift action of the prize ring has given place to the slow wrenching and twisting of a pair of heavy-muscled giants upon the wrestling mat; and it begins to look as though the fight would be won by the sheer exhaustion of one or other of the two great armies which are writhing in a close-locked embrace, all the way from the waters of the Channel to the mountains of the Swiss frontier.

It is perfectly conceivable that if the great Napoleon himself were alive to-day and were in command of one of the French armies, we should hear no more of his particular work than we do of that of any one of the French generals who are so successfully holding the German army at bay.

German Patents and Trade-marks in England

SOON after the declaration of war an act was passed by the British Parliament granting to the Board of Trade temporary powers to order, on the application of a person interested and after due inquiry, the avoidance or suspension of patents, designs, and trade-marks owned by the subjects of a state at war with Great Britain. In two months about one hundred applications were received from British business men asking for permission to make products protected by English patents granted to Germans, and about the same number of applications for the right to use German trade-marks which have been widely advertised in England.

In justice to the British authorities, it must be stated that these applications will be granted not for the mere asking, but only after due cause has been shown. Nor are the patents themselves to be revoked or confiscated. The general plan seems to be the granting of licenses and the payment of royalties to the British government during the continuance of the licenses. The continuance of the license after the war will probably be made subject to a royalty payable to the patentees.

The losses that German manufacturers and merchants will sustain by this procedure cannot be calculated. One well-known firm of English chemists has applied for the right to manufacture "Salvarsan" in England under the patent granted to Messrs. Meister, Lucius and Brüning of Frankfort. Other applications affect German patents for the making of artificial teeth and the manufacture of electric igniters for explosion motors. At least one hundred of the more valuable patented products which Germans have developed only after the most painstaking research and the expenditure of vast sums are likely to be made by British firms who have contributed in their development not one whit of intellectual effort or a single penny in money.

The situation in trade-marks is equally serious. Thus the valuable trade-mark "Pebeco" for a tooth paste manufactured by Beiersdorf & Co. of Hamburg, the mark "Aspirin," the name of a well-known drug manufactured by Bayer & Co. of Germany; the trade name "Formamint," owned by von Wuling of Berlin, and other marks, made priceless by sound business methods, are likely to appear upon British equivalents.

No wonder that the German technical periodicals contend that this procedure is additional evidence of England's commercial jealousy. Such contentions are, of course, absurd. On the other hand, no more telling proof of German manufacturing ability and German business enterprise could possibly be obtained than this piracy, this permissible infringement, under the guise of law. The Comptroller-General of Patents seems to have realized this.

"Why do you say they have obtained this large reputation?" he asked the lawyer representing the firm of English manufacturing chemists who applied for the right to use the trade-mark "Pebeco." "Is it because they have taken greater trouble to push their goods while British manufacturers do nothing? One has found it over and over again during the few days one has been sitting here that British manufacturers say 'We can supply goods equally good, but the sale is not so large.'"

To which the lawyer frankly replied: "It is because they have not been so energetic as the Germans."

After this avowal the act itself reads almost like a ridiculous pretext for seizing the fruits of German science and business enterprise. The applicant merely has to prove that the patent is held by an alien enemy, that he himself intends to work the invention in the British realm, and that it is to the general interest of the country or a section of the community or of the trades that the patent shall be so worked in Great Britain. The door is open for the practice of frauds upon the public, no matter how carefully the Comptroller-General carries out his intention of granting applications not merely for trade-marks, but only for trade names which alone identify articles.

That Germans and other "alien enemies" of England will retaliate in kind is to be expected, and their form of retaliation will probably be no more commendable than the British act. War is indeed a splendid excuse for bringing out commercial pastimes. Sound business cannot be built on the moral principle which legalizes such robbery.

Baltic Ice and the War

THE Russians have a saying that General January and General February are their best allies in the task of defending the Czar's empire. This saying, of course, calls to mind, first of all, the hard ships inflicted upon invading armies by the rigorous Russian winter, as during the retreat of Napoleon's grand army from Moscow, and again during the winter campaigns of the Crimean War.

The situation with respect to naval warfare is, however, complicated by the fact that while many European ports are made inaccessible to an enemy by ice during the cold season, the same ice tends to immobilize the Russian fleet. Thus the advantage gained in defense is offset by a diminution in the powers of offense. These conditions must be reckoned with in the present war.

At this writing the German fleet and coast are threatened by the naval forces of Russia in the battle of the Baltic and those of Great Britain in the North Sea. To what extent this will be true during the winter will depend somewhat upon whether the season proves to be mild or severe. In the North Sea ice never offers a serious obstruction to steam navigation except—and then rarely—along the coasts and in the mouths of rivers. In the Baltic, much of the sea is choked by ice every winter, though conditions vary immensely from year to year and from place to place. Entrances to the principal ports, except in the extreme north, is, however, facilitated by the use of ice-breakers. Thus even in the Gulf of Finland, in March, 1896, the ice-breaker "Ermack" steamed through fixed ice, two to three feet in thickness, at the rate of six to eight knots, from the meridian of Reval to St. Petersburg, making a channel of her own width 160 miles long. Hence, of the two great Russian naval ports on the Baltic, Kronstadt can be kept open during at least a part of the nominally closed season by artificial means, while Libau is naturally ice-free except in winters of most unusual severity. One of these exceptional cases was the winter of 1892-93, when Libau was closed to navigation from January 16th to March 18th. All the German Baltic ports are easily kept open to steamers by the use of ice-breakers when necessary.

The Cruiser Fight in the Pacific

OUR illustration of last week, showing the fleet of ships of the Allies which had been sunk by the German navy, was completed before the news arrived of the recent German naval victory in the Pacific, and hence the British ships which were sunk or disabled by German gunfire in this engagement were not included. The fight, which took place off the Chilean coast as night was coming on, was a most dramatic one—short, sharp, and decisive. At the present writing, the only details of the engagement are those which have come from German sources, the British Admiralty announcing that it has not as yet received any official accounts of the disaster. Although the British squadron was outnumbered in the proportion of five warships to three, and was greatly outmatched in the number of armor-piercing guns carried, namely, sixteen to two, this does not detract from the great credit which is due the German admiral for having concentrated the widely-scattered German vessels in the Pacific into a compact squadron, and having so maneuvered as to engage the British forces with an overwhelming superiority. The difficulty of this feat will be appreciated, when it is borne in mind that the Germans have no coaling bases available in the Pacific, and that they are under the necessity of replenishing their stores of fuel and supplies during limited visits to such neutral ports as may be available.

According to the German reports, the engagement opened at long range, according to first accounts about 9,000 yards, the ships drawing in to about 4,500 yards at the close of the fight. The British squadron consisted of the armored cruiser "Good Hope" of 14,000 tons, carrying two 9.2-inch and sixteen 6-inch guns, and "Monmouth" of 9,800 tons carrying fourteen 6-inch guns, and the protected cruiser "Glasgow" of 4,800 tons mounting two 6-inch and ten 4-inch guns.

On the German side were five vessels, the armored cruisers "Scharnhorst" and "Gneisenau," of 11,600 tons and each carrying eight 8.2-inch and six 6-inch guns, and the protected cruisers "Nurnberg," "Leipsig," and "Bremen," mounting between them thirty 4.1-inch guns. The German armored cruisers concentrated their broadside of twelve 8.2-inch guns on the "Good Hope," and she was quickly put out of action. The "Monmouth" interposed, and her 4-inch side armor was easily penetrated, and the ship sent to the bottom. The "Glasgow" and the transport "Otranto" escaped, but have not been since reported. The "Scharnhorst," "Gneisenau," and "Nurnberg" put into Valparaiso, but the whereabouts of the "Leipsig" and "Bremen" is still in doubt.

Engineering

...ing Alexandria, Egypt.—The m...ni...ipality ...Egypt, has decided upon a modern drainage for that city. The work will comprise a ...m of sewers, a pumping station at Kaid Bey, ...outfall to the sea.

...dway Ties in Switzerland.—Metal ties were ...Switzerland in 1881, since which time they ...d to a large extent the wooden tie. About ...f the ties used by the Federal Swiss Railway ...f metal. These ties are 9 feet by 9¼ by 5¼ ...ing 190 pounds, and selling for $2.30 against ...0 for oak ties. German iron foundries have ...pplied the metal ties.

...ts from Small Products.—Knitting machine ...lished the United States from Saxony last ...alued at $138,000. The largest knitting-...ory in Chemnitz aggregated $2,855,000 in ...machines, and since its formation in 1889 ...amounted to $23,000,000. This company ...dividends for the last three years amounting to 30 per cent, 24 per cent and 27 per cent.

...Telegraph and Telephone in India.—New radio ...were opened at Karachi and Butcher Island, Bombay, with a working range of 600 miles, over 2,000 miles of line and 11,000 miles of wires and cable; and 183 telephone exchanges were established in India last year. The telephone lines at Delhi and Simla were also placed underground. Nearly 16,000,000 telegrams provided a gross revenue of over $5,000,000.

...tric Power for Swedish Railways.—Until ...the government built its large plant at Trollhatten, all the hydro-electric plants in Sweden were owned as private enterprises. The government has two other large plants under construction at Daleff and Porjus in Lapland, which as soon as completed will furnish the power for the state railways in northern Sweden. The water falls of Sweden have been calculated to contain 6,000,000 horsepower. About 16 per cent is utilized at present.

...creasing Output of Japanese Mines.—With the introduction of modern machinery, the output of the mines of Japan have increased in value in ten years from $28,500,000 to $66,000,000. The Nagasaki district the most important, has shown a steady growth in its output of coal, copper, zinc, gold and silver. The production of coal has increased rapidly with a demand for Japanese coal in all the ports of the Orient. This demand has extended to the west coast of America, over $500,000 worth having reached San Francisco this year.

Ball Bearings in Sweden Remunerative.—The leading manufacturer of ball-bearings in Sweden, Aktiebolaget Kullagerfabriken, with a plant at Goteburg and branches in France, Germany, Denmark, England and the United States, has declared a dividend of 15 per cent on its capital stock of $1,600,000 and has increased the capital stock to over $3,000,000. It is said on good authority that the dividend required less than one half of the net earnings. The state railways have recently decided to use ball-bearings on all their rolling stock. The state railways of Sweden are progressive. Though the private lines have a mileage of double that of the state lines the gross income last year on the private lines did not equal that of the state lines.

New Roads in Ecuador.—There is but one completed railroad in Ecuador, that between Guayaquil and Quito. Until this road was extended in 1905 Quito was, by modern standards, considered to be shut out from the world. Another road, the Ambato-to-Curaray Railway, 190 miles long, is under construction which will connect the Guayaquil and Quito Railway at Ambato with the easterly provinces of the republic. The last consignment of rails for this new road is expected about November. Two Baldwin locomotives have been received and other rolling stock has been ordered from the United States. The preliminary survey is nearly completed for still another railroad between Puerto Bolivar and Borja known as the trans-Amazon Railway. This road will connect the Pacific coast with the head of navigation on the Maranon River, the name by which the upper Amazon is known as it passes through the Peruvian Andes within a hundred miles of the Pacific Ocean.

Grain Docks and Floating Elevators at Antwerp.—The "dock of concentration" at Antwerp was, by the action of the city authorities just prior to the declaration of war, to have been a reality in 1916. The plan, conceived ten years ago, is to concentrate at one great dock all the grain barges which serve as warehouses, and the floating elevators which furnish the business to Antwerp's 300 grain houses. These elevators, with eight new ones voted last year, are twelve in number and are owned by the municipality. They are pneumatic with a lift of 100 feet and one cares for a cargo of 5,000 tons in about three days which formerly detained a vessel there for fourteen days when hand labor was employed. While hostilities may perhaps set the work back another decade, hope may be derived by Antwerp and other stricken cities by remembering how calamity often has a most stimulating effect upon industry—as in such notable cases as San Francisco, Baltimore, etc.

Science

A School of Colonial Agriculture has been established at S. Ilario Ligure, Italy, by the Italian Ministry of Agriculture. A three-year course will train students for practical farming in the Italian colonies.

Atmospheric Air and Tuberculosis.—One of the prize papers presented in connection with the tuberculosis congress in Washington was that by Dr. Guy Hinsdale on Atmospheric Air and its Relation to Tuberculosis. This paper has been printed and issued by the Smithsonian Institution.

The Development of Heat by Plants in Dewar flasks has been studied recently by H. Molisch. The flowers, leaves, and fruits of a large number of plants showed great contrasts in the amount of heat developed. Most leaves and flowers developed considerable heat; mosses, algæ, and a number of common fruits, very little. Lichens and fungi showed a wide range in this respect.

Prof. Hermann J. Klein, who died last summer at Cologne, Germany, was well known for his popular writings on astronomy and meteorology; also as the editor of the journals *Sirius* and *Gaea*, and the annual publication called *Jahrbuch der Astronomie und Geophysik*. Among his voluminous works the one that is probably most highly esteemed in England and America is his "Star Atlas" (English translation by McClure).

Technical Meetings and the War.—The war has entirely upset the programmes arranged by the various English engineering socities for this fall, and most of them have had to be postponed indefinitely, such as that of the Iron and Steel Institute, which was to have been held in Paris on September 21st, and the Institute of Metals that was scheduled at Portsmouth on September 10th. The Institution of Mining Engineers was held as usual.

German Scientists in Australia.—A number of distinguished German scientific men who recently went to Australia to attend the meeting of the British Association for the Advancement of Science have been interned in that country by the Commonwealth government on account of the war. They will, of course, receive the best of treatment during their nominal imprisonment. They have been supplied with ample funds by the treasurer of the British Association.

An Interesting Example of the Brocken Specter was recently described by Sir Thomas Holdich at a meeting of the Royal Geographical Society. It appears that there is a mountain called Omi on the borders of China and Tibet, where it was claimed that the devout worshipper might occasionally see, from the summit, the image of his great teacher Buddha approaching the mountain. This belief was recorded as a mere idle superstition by explorers, until one of the latter happened to ascend the mountain under suitable atmospheric conditions and saw his own, apparently colossal, shadow cast by the sun upon a bank of fog; in short, the well-known specter of the Brocken.

Portraits in Colors.—A new process is now announced which it is claimed gives remarkably perfect results, and is simple enough for practical commercial purposes, although not suited for amateur work. This process is stated to be a modification of the Ives three-color process, except that only two colors are used, red and green. Two negatives are taken in a special camera, or in a regular camera using color screens. These negatives are so treated with dyes that the coloring matter replaces the silver in the film, and the plate becomes its own positive. The two plates are superimposed, and mounted in a frame so constructed that an electric light may be placed behind the picture, which is to be viewed by transmitted light. This process has been perfected by Dr. C. E. Kenneth Mees, a physicist connected with the research laboratories of the Eastman Kodak Company, with the assistance of Mr. John G. Capstaff, and is claimed to give remarkably faithful reproductions of colors, features and fabrics in protrait work.

Observing the Eclipse in Russia.—One of the expeditions to Europe to observe the recent eclipse of the sun was made by Prof. David Todd, of Amherst College. Arriving at Libau, Russia, he found that in the neighborhood of forty other parties were located at Riga, the nearest point in the path of the eclipse, so he decided to try some other place. Through the chief observer of the Imperial Observatory, at Petrograd, he received an invitation to make his observations at a private estate near Kiev, but his host was called away by the mobilization of the troops, and Prof. Todd accepted the invitation of another gentleman at Semla, a hundred miles south. As rail transportation was disorganized, Prof. Todd's instruments were delayed and did not reach him until too late to unpack and set up, but in the meantime he secured a very good lens in Kiev, with which he arranged a photographic apparatus, and he secured some photographs showing the solar corona quite plainly, although conditions were far from favorable, as a bank of clouds extended over that section of Russia during the eclipse, while the other points of observation enjoyed a clear sky. After his work was completed, Prof. Todd had some difficulty in getting out of the country.

Inventions

A Tramping Packer for Silos.—George C. Park of Anadarko, Okla., in patent No. 1,111,610, shows a packer suspended within a silo and which can be raised and lowered and rotated to pack with a tramping action at any point within the silo as the filling of same proceeds.

An Aeroplane with a Safety Plane.—Philip H. Smith of Pawling, N. Y., has obtained patent No. 1,110,355 for an aeroplane which has an auxiliary safety plane capable of release and independent action as related to the main plane and designed to prevent precipitate descent in the event of motor failure or other mishap.

An Edison Sound Modifier.—In patent No. 1,110,382, issued upon the invention of Thomas A. Edison, the sound conveyer of a phonograph is provided with a spherical sound modifier together with means for adjusting the modifier back and forth into different positions within the conveyer; the means including a rotatable bobbin and a returning spring.

A Tell-Tale for Bottles.—Charles J. Canda of Elizabeth, N. J., in patent No. 1,110,886, shows a tell-tale for bottles which is located in the bottle neck below the closure and is of such material that when it is considerably deformed, as would be the case in pushing it down for dispensing the contents of the bottle, it cannot be brought back into its approximate original shape

Utilizing Talking Machine as a Burglar Alarm.—Patent No. 1,111,190, to Axel Stahl of Chicago, provides a talking machine which is started to give an alarm in the event of a window or door being opened by an intruder. It offers vast opportunities in the selection of exclamations and phrases designed to frighten away the would-be burglar.

A Canal Zone Aerial Life Saver.—In patent No 1,110,710, to David Williams Ogilvie of Balboa, Canal Zone, is shown a life-saving device for aeronauts in which reversely related parachutes are secured to the garment at substantially the waist line thereof and suitably stayed from the garment, one parachute coming into play if the aeronaut falls head first and the other if he falls feet first.

A Stabilized Flying Machine.—Patent No. 1,111,627, to James L. Walker of Grand Island, Neb., seeks to provide a novel construction of flying machine of the aeroplane class which possesses both inherent and automatic stability, and which under ordinary conditions, when its balance is disturbed, will of its own volition adjust itself for the action of the air to return it to balanced position.

Seeks a Resilient Railroad Tie.—Seeking to provide a durable and resilient railroad tie, George H. Hardman of Fall River, Mass., has secured patent No 1,110,684 for a railroad tie composed of small trees, saplings or branches and an asphalt binder placed in a mold and pressed to the desired form and density, frames being provided at the top and bottom and connected by bolts.

Combined Typewriter and Adding Machine.—Fred F. Main of Chicago, Ill., assignor to John T Underwood of Brooklyn, in patent No. 1,110,448 provides a typewriting attachment for adding machines in which the printing platen is common to the printing mechanism of both the typewriter and the adding machine and the operating shaft of the adding machine may be manipulated to bring the platen into printing position relative to either set of apparatus.

Theatrical Illusion Apparatus.—Patent No. 1,110,665, to Timothy R Barrett of Bordentown, N. J., is for an illusion apparatus in which a background and foreground are provided in connection with a treadmill and a movable representation of a vehicle or car which can be moved toward and from the treadmill so that a person on the treadmill can convey the impression to the audience that he is apparently in pursuit of the vehicle and can fall or otherwise produce amusing effects in simulating an effort to overhaul the car.

Some Bowling Ball Patents.—John W. Hyatt of Newark, N. J., has patented, No. 1,111,022, a bowling ball, seeking to furnish a substitute for solid ball of wood or the like, by constructing the ball with a hollow metallic body on which is cemented a layer of fibrous material which is covered with a relatively non-yielding homogeneous composition. The same inventor has secured a patent, No. 1,111,023, in which is shown a hollow bowling ball with a novel construction of disappearing finger hold or handle.

Issued Patents Geographically Classified.—It is interesting from time to time to notice the geographical distribution of the issued patents. A review of the patents issued on September 15th, 1914, shows that patents were issued on that day to residents of every State save three, Arizona, Nevada and Wyoming. New York leads the list with a round one hundred patents. New Jersey comes next with sixty-six. Illinois is a close third with sixty-five, and Ohio has fifty-seven. The District of Columbia had eight, a large number when the population relatively to that of the States is considered.

Lock-Entrance Caisson for the Panama Canal

ON the 16th of September last an enormous caisson was completed at San Francisco for the Panama Canal.

It is to be used as a barrier or dam, across the entrance to any one of the lock sites when repairs or painting are required to be made to the mitering lock gates. It can also be used for unwatering any one of the lock chambers to permit of making an inspection of the culvert stony gates or cylindrical valves installed within the lock walls

It is the largest gate of its kind ever constructed having a length of 113 feet 10 inches, extreme depth, 66 feet; molded breadth, 36 feet; and displacement, 2,583 tons at light draft of 32 feet. The maximum draft when in service is 62 feet.

The sides of the caisson have curved surfaces throughout, with lines like those of a ship. Along its ends, which are vertical, as well as along the horizontal keel, there are heavy plate girders fitted with continuous timber cushions which serve, when the lock is pumped out, for transmitting the water pressure to smooth cast iron plates attached to the masonry

Structurally, the caisson consists essentially of horizontal plate decks, girders, and stringers; transverse and longitudinal framing and bulkheads; plate breastbooks at the ends of the caisson, girders along the vertical ends and keel, and steel plating or sheathing that covers the skeleton The design is such that the decks, girders, and breastbooks serve to transmit the greater part of the hydrostatic pressure to the side walls of the locks, the balance of the loading being carried to the horizontal sill by the vertical, transverse framing

The caisson is equipped with a very large pumping system, consisting of four 20-inch discharge, vertical centrifugal volute pumps, placed about 12 feet above the keel Each pump has an average discharge of 13,000 gallons per minute when pumping out of the lock chambers Each pump is driven by a 225 horsepower electric motor, located 37 feet above the keel. The deck is made absolutely watertight and serves as the top of the water ballast compartments The piping system in connection with each pump is so arranged as to enable the operation of the suction discharge to take place from either side of the caisson. Two of the pumps have connections made in such a manner as to be used for emptying the water ballast compartments when it is desired to raise the caisson out of its seat, after it has served its purpose at the lock entrance. All the valves, motors, etc., are arranged to be manipulated from the caisson's operating deck.

Electric current is supplied to the motors from the main power cables installed within the locks. The motors, therefore, cannot be operated until the caisson is placed in one of the recesses provided for it in the lock chambers, or when at its mooring position in Gatun or Miraflores lakes.

It required 1,500 tons of structural steel to build the caisson and 800 tons of permanent ballast placed in its bottom to give it stability in its light draft condition.

Planets and the Weather

DO the planets affect the earth's weather? This well-worn question is discussed in a somewhat novel way by Prof. W. J Humphreys, of the Weather Bureau, in the *Monthly Weather Review*. The writer frankly admits that the planets do affect the weather, though to a very slight extent, and he explains just how and how much The weather ultimately depends upon the reception and emission of radiant energy by the atmosphere. This energy, of course, comes mainly from the sun; but the planets send us a little, and they also affect the amount received from the sun by changing the earth's distance from that luminary through the perturbations they produce in the earth's orbit. The energy received from the planets may be expressed in terms of their brightness, and this varies greatly. The light of all the planets, each at its maximum, is about equal to that of 200 stars of the first magnitude, while the light of the sun is roughly equal to that of 73,000,000,000 first magnitude stars. With their varying distances, the range in the aggregate brightness of the planets may amount to the light of 240 first magnitude stars, though it is rarely more than 230 such units. From these figures it may be calculated that variations in the planetary distances can produce a maximum change of about one two-millionth of a degree Fahrenheit in the temperature at the earth's surface. The change of the earth's distance from the sun, due to perturbations in its orbit caused by the planets, is a much more important factor in determining terrestrial temperatures, though it, also, is practically negligible. Jupiter changes the distance of the earth from the sun by about 1 part in 20,000; Venus and Mars, each by about 1 part in 90,000. The total change due to the combined action of all the planets is seldom greater than 1 part in 17,000. The maximum effect of this fluctuation under the most favorable circumstances is found to be about 0.02 deg. Fahr. in the earth's surface temperature.

"Ordinarily, though perhaps not always," says Prof. Humphreys, "this, [illegible] climate are concerned, [illegible] range," and the variations [illegible] common with the astrological [illegible] seems usually to be in the [illegible] that the planets do greatly influence [illegible] weather and our climates." As to [illegible] Humphreys shows that its rotation [illegible] the surface temperature of the equator [illegible] deg. Fahr., while the moon's perturbations [illegible] the earth's orbit may produce a maximum [illegible] terrestrial temperatures about equal to [illegible] attributable to the planets, viz., 0.02 deg. [illegible] important possible effect of the moon spoken [illegible] is, however, hinted at; the tidal action [illegible] affects the flow of ocean currents, and [illegible] may be concerned with small but measurable [illegible] in the weather of certain localities.

Award of John Scott Medal for Ignition System

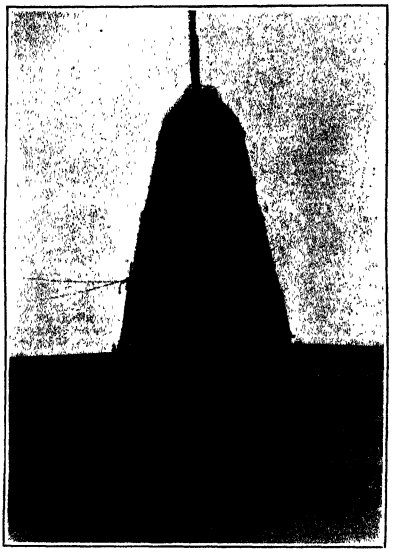
THE city of Philadelphia has awarded to Mr. Arthur Kent the John Scott legacy medal and premium of the Franklin Institute for the Atwater Kent unisparker and ignition system. The formal ceremony of conferring the medal will take place on November 18th at the regular meeting of the Franklin Institute.

This medal and premium was bequeathed by John Scott, chemist, of Edinburgh, made in the year 1816, creating an endowment to the city of Philadelphia, directing the interest and dividend to be distributed annually among "ingenious men who make useful inventions."

In 1834 the city of Philadelphia vested the award of this medal in the Franklin Institute of the State of Pennsylvania.

This is probably the first award of such a character that has been made in America to any manufacturer of automobile parts.

The device consists of a contact-breaker, governor, and distributor, arranged in one structure. The contact-breaker is in the primary of a non-trembler coil circuit, and is so designed as to be operative only when the engine runs in one direction, thus preventing backfiring. The governor automatically advances and retards the spark according to the requirements of the engine. The distributor is in the secondary circuit of the coil and distributes the sparks to the several cylinders. The current in the primary circuit can be reversed at will, changing the polarity of the contacts and preventing their disintegration.



Completing the work on the caisson in drydock.

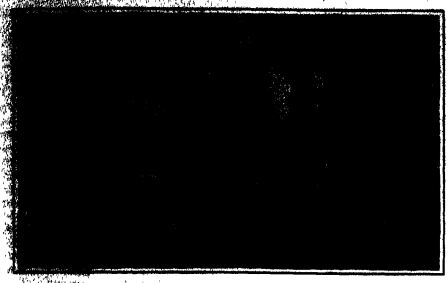


Launch of the huge caisson for the Panama locks.



Start of the long journey down the coast to Panama.

LOCK-ENTRANCE CAISSON FOR THE PANAMA CANAL



Forest ranger using shoulder-pack water-bag and fire shield in putting out a surface fire.



Fighting a forest fire with shoulder-pack and air-pressure horse-pack apparatus.

Forest Fire Fighting

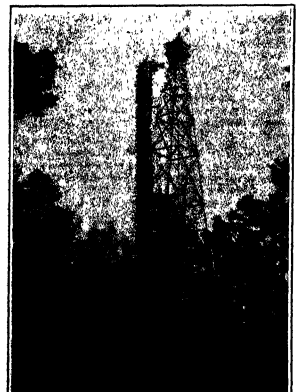
Construction of a 115-Foot Watch-Tower With Limited Equipment

THE 156 national forests of the United States, not counting the reserves in Porto Rico and Alaska, cover an area four times that of the State of New York. As may well be imagined the task of caring for these enormous stretches of timber land is no small one. The principal danger is fire, which annually exacts a levy of many thousand dollars' worth of timber. In order to reduce the loss to a minimum the Government has established novel fire departments in the timber lands. Of course the main object is to locate the fire quickly and bring the fire fighters to the spot before the blaze has assumed dangerous proportions. The difficulty of doing this in large wooded areas is at once apparent. The old watch tower system used in our cities before the electric fire alarm came into use has been adopted by the Government. Lookouts are posted at strategic points throughout the range, and their duty is to sweep the forest with their binoculars in order to detect the first curl of smoke rising above the tree-tops, which would indicate that a fire had started. Then by means of range finders, or triangulation with another tower, the exact spot is located and telephoned to the fire fighters of the particular district in which the fire has started. In an incredibly short time the forest fire department is on the spot with water-bag, chemical tank, rake, shovels, etc.—a variety of tools unknown to the city fire department. It is usually the brush that takes fire first, and when it is impossible to put out the blaze with the water bag, the fire is encircled with a bare strip of ground from which the leaves have been raked up, and the brush chopped down. Then a counter fire is started, burning in toward the original fire so that eventually the blaze burns itself out for lack of further fuel. The accompanying photographs illustrate some of the apparatus employed. The equipment has to be transported to the scene of the fire on the backs of horses and mules, and consequently it must be of very light construction. The "shoulder-packs" consist of water-bags that are carried on a man's back, and are fitted with a hose and spray nozzle with which he can direct the stream where it will do the most good. As the pressure of the stream is very small, due to the low head of water in the bag, the fire fighter has to walk in close to the fire, and, hence, to protect himself from the intense heat, he has to use a shield, such as is shown in one of the photographs. In addition to this there are pressure-tanks carried by horses with which a more efficient stream of water may be directed upon the fire. In some cases chemicals similar to those used in our chemical engines are used and are carried in a couple of copper cylinders on horseback.

The forester must be an all-around man and ready for all emergencies. An example of his resourcefulness is shown in the building of a watch tower 115 feet high, which is illustrated herewith. It was a remarkable piece of work under the circumstances, and a detailed description of the manner in which it was erected will be found very interesting. The tower is located in the Sitgreaves National Forest, Arizona. A triangulation station was needed in one of the districts, but because the area was covered with tall timber and had a very gentle slope, no good natural lookout post could be found at the west end. Several points were considered where the timber was only 35 to 40 feet high, and where a 40 to 50-foot tower would be sufficient; but as it proved, there was only one point from which a satisfactory view over the forest in all directions could be obtained, and here, unfortunately, the timber was so tall that the tower would have to be at least 100 feet high. The tools and rigging at hand were sufficient to build a tower of only half that height, but, nevertheless, it was decided to undertake the building of the tall tower at once, without waiting for further equipment, for the reason that the nearest base of supplies was 75 miles away, and the dangerous fire season was close at hand. The materials available consisted of 300 feet of ¾-inch rope in four pieces, the longest being 100 feet in length; two double blocks 6 inches long, and one single sheave block of the same size. The tools consisted of axes, two-men saws, hatchets, crowbars, two pairs of lineman's climbers and belts, and a brace and bit. Telephone wire was used for guys. The crew was made up of temporaries and two rangers under the direction of one of the forest rangers. At the start there were eight men, including one cook, one teamster, and the man in charge. By the time the tower was half built the crew was cut down to four men.



Forest service mule with his load of fire tool boxes.



Fire lookout 115 feet high, built by a crew of resourceful forest rangers at Promontory Butte, Sitgreaves National Forest, Arizona.

The first task was to cut and peel the timbers and skid them to the spot where the tower was to be erected. Much care was necessary in selecting the main poles, some of which were skidded out of dense thickets. Altogether, over one half mile of poles, linear measurement, was used.

The dimensions of the tower are as follows: Base, 30 feet square; platform, top, 6 feet square; height, 115 feet.

The main corner poles average 16 inches in diameter at the butts and 4 inches at the top. They are spliced at a height of 45 feet and at 100 feet. Each splice is bolted and then bound with bands of telephone wire. The timbers are fastened together with ½-inch lag screws.

In raising the poles a tree nearly 100 feet in height was used to hoist from, but since the top of this tree was not stout enough above a height of 75 to 80 feet to carry much weight, some difficulty was experienced in placing the 55-foot poles upon the top of the 45-footers. With an abundance of rigging, a derrick boom could have been rigged, but it must be remembered that there were only three pulley blocks, and they had to be used in hoisting each pole or brace. The men were so short of rope that when they raised the second length of the main poles, it was necessary to hoist until the blocks came together, lash the pole so that it could not fall, and then stretch the tackle for another pull.

None of the crew had had any previous experience in building towers, and they were by no means expert climbers at first, but they improved rapidly, so that before the tower was completed several of them were excellent men for high work.

The first poles were cut on May 21st, and the tower was completed and in use on June 20th. The time spent in cutting and peeling logs and constructing the tower amounted to less than twenty-four working days of eight hours each for a crew which averaged five in number.

The Periodicity of Sun Spots

THE sun-spot period, evaluated as being 11⅛ years, is only an approximate indication which does not account with precision for the facts of observation. In a series of notes to the monthly notices of the Royal Astronomical Society, Turner shows that other periods of 8⅛, 10½, 14⅜ years must be considered, although the period of 11⅛ is much the most important for our present epoch, a fact which confirms the recent researches of Schuster and Michelson. But, unless one wishes to throw grave doubt on some of the earlier observations, it would appear that this period does not satisfactorily fit in with the sun-spot phenomenon as manifested during certain years. For instance, the period 10¼ years seems specially concordant with the phenomena observed from 1749 to 1830; after which the cycle of 14⅜ years appears to be most important.

In spite of the ingenious attempts which have been made it will be seen that the details of the mechanism of the solar activity remain very mysterious.

A Vaccine for Rabies

THE learned and well-known French naturalist, Mme. Phisalix, has for some time been conducting experiments with the venoms of various batrachians and serpents. She has just completed these, says *La Revue (Paris)* by a series of experiments, which have for their object the successful vaccination of animals against the much-dreaded disease of rabies. "This learned naturalist discovered some time ago," we read, "that the mucous secretion of batrachians has the property of immunizing against its own action, and also against that of the venom of the asp.

"Proceeding from this point Mme. Phisalix formed the idea of utilizing the seminal fluids for immunization against the virus of rabies. She injected into rabbits mucus from the salamander, repeating the operation at several days' interval, and afterward inoculated them with about ten milligrammes of the venom of the asp viper, a dose twice as great as that which suffices to produce death.

"A week afterward they were trepanned and the fixed virus of rabies was injected into the meninges. The rabbits thus vaccinated by an association of the vaccine of the salamander and that of the asp manifested no symptoms of rabies; only one was attacked. The duration of the immunity, it is true, was not very long, and the effects of the remedy do not generally persist beyond six weeks.

"Mme. Phisalix also tried to determine whether one of the two venoms had a preponderant action. Hence she immunized some rabbits with the vaccine of the salamander and others with the vaccine of the asp viper. The results were not so conclusive as with the association of the two vaccines. . . . The continuation of these remarkable experiments is awaited with interest."

To this summary by Dr. Case we may add the detailed report of certain observations made by Mme. Phisalix and presented to the French Academy in July by Edmond Perrier as follows:

"Most authorities admit that cold-blooded vertebræ are refractory to rabies. But this opinion has been verified for only a few species. Remlinger inoculated with the fixed virus of rabies fish, and the Mauretanian turtle without infecting them. . . . Since 1910 I have frequently and at different seasons inoculated with the fixed virus many species of batrachians and reptiles, employing in each series as many subjects as were necessary to vary the place of inoculation: subcutaneous conjunctive tissue, peritoneum, muscles, anterior chamber of the eye.

"Experiments on *Rana temporaria* and *esculenta*, *Bufo bufo*, *Salamandra maculosa*, among the batrachians; on *Anguis fragilis*, *Tropidonotus natrix* and *Vipera aspis*, among the lizards and serpents. In ten series of these animals three were kept at 35 deg Cent. by stove heat. . . . without the results furnished by the other groups being modified. These results were entirely negative as regards most of the preceding species; but salamanders and vipers constantly died after inoculation with the fixed virus, the first in 5 to 12 days, the second in 5 to 8 days with symptoms of paralysis like animals suffering from rabies. These experiments were performed on 48 vipers and 22 salamanders. The place of inoculation made no difference in the length of survival; thus the vipers died no quicker when the virus was in the eye than when the inoculation was made under the skin.

"These vipers, which were possibly infected with rabies, were, however, paralyzed only in the muscles of the body, for they could bite by erecting their venomous fangs if strongly excited; but it was impossible to them to assume the attitude of defense and to extend themselves suddenly, as they ordinarily do. Left to themselves they remain immobile until death.

"The autopsy on salamanders and vipers dead after inoculation with the fixed virus revealed only very slight congestive lesions, without a determined fixity. The encephalon emulsified and used to inoculate healthy subjects, made them die, at first in the same time as the fixed virus; then the duration of survival diminished by degrees, and in both cases was not more than 2 days after the fifth passage.

"Did the vipers and salamanders die of rabies? The test inoculation under the meninges of the rabbit, which gives absolute certitude, as proved by Pasteur and Roux in 1881 was performed. The rabbits were trepanned and inoculated with the suspected emulsion of the brain of the viper and of the salamander. None of them took rabies, and moreover none of them was immunized against the fixed virus, used for inoculation one month and months afterward. *Hence the vipers and salamanders did not die of rabies.*

"Were they, then, sensitive to inoculation with nonrabic cerebral substance? Yes; this was fully confirmed by experiment. *The normal nervous matter of rabbits or that of their own species, is a poison for the viper and the salamander, while it has no injurious actions on other animals even when inoculated.*

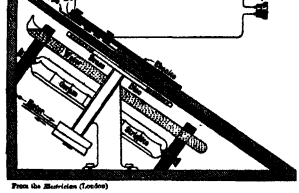
"These experiments prove that the toad, slow-worm, adder, are, like the frog, fish, and Mauretanian turtle, refractory to experimental rabies communicated by inoculation with the fixed virus, and that the exceptions presented by the terrestrial salamander and the asp viper are because these are poisoned by their nervous substance and by that of the rabbit, whether the latter be healthy or rabic."

Hearing Print

By the English Correspondent of the Scientific American

SOME time ago the SCIENTIFIC AMERICAN published an account of Dr. Fournier d'Albe's instrument for rendering differences of lighting audible. Since then the apparatus has been greatly improved and it is now possible for the blind to read by the sense of hearing, just as with the Braille type they read by the sense of touch. The apparatus by which this is accomplished is essentially an ingenious application of the fact that the substance called selenium has the peculiar property of changing its electrical resistance with changes in the intensity of the light illuminating it. If therefore this substance forms part of an apparatus (such as a Wheatstone bridge) which is so constructed that fluctuations of resistance produce electric currents, we can, by passing these currents through a telephone receiver, cause variations in intensity of illumination to produce sounds. This is the root principle of Dr. Fournier d'Albe's optophone. In the latest form of the apparatus the light used to illuminate the selenium is intermittent in character. Selenium is capable of following fluctuations in intensity of light with extreme rapidity, although in converting light oscillations into telephone sounds the higher notes would be feebler than the lower ones were it not that this tendency is largely counterbalanced by the resonance of the ear and of the telephone membrane. It is found in practice that maximum audibility occurs somewhere about a frequency of 1,000 waves per second.

The optophone used for reading purposes is illuminated by a line of light broken up into dots, the light



From the Electrician (London)

Diagram showing general arrangement of Dr. Fournier d'Albe's reading optophone.

of each dot being intermittent and with a frequency different to that of the others. Thus, in one apparatus actually constructed the frequencies of the eight dots composing a line eight centimeters long are in the ratio of the numbers of the diatonic scale, the eight dots forming an octave with its intermediate intervals. The actual frequencies are 24, 27, 30, 32, 36, 40, 45, 48.

By passing opaque bodies between the light and the selenium so that the dots of light are interrupted, changes of sound in the telephone are produced. Dr. Fournier d'Albe accordingly had large type printed on gelatine or other transparent material and passed between the light and the selenium. He found that the resultant sounds varied, as would be expected, with the shape of the obstruction, in this case a printed letter of the alphabet, and with a little practice the letters of the alphabet could be recognized by the ear.

The diagram shows the general arrangement of the apparatus. The line of light is furnished by an Osram "striplite" of 100 candle-power, which is concentrated by means of a cylindrical water lens upon a revolving perforated brass disk provided with eight circles with the number of holes requisite to give the eight various frequencies. The disk is spun at about 20 or 30 revolutions per second by means of an electric motor. The line of dots of eight different frequencies exists, therefore, just at the surface of the brass disk. As it is not feasible to bring the transparency to be "read" into contact with the brass disk, the luminous dots are transferred to the upper side of a wooden partition by means of a set of glass rods with flat ends embedded in the wood opposite the luminous dots. The flat ends of the rods are flush with the surface of the board, and the transparency can be safely and conveniently slid across them. The selenium bridge *Se* is mounted above the transparency with just sufficient clearance to allow for free displacement. The luminous dots transmitted by the type or other transparency impress their frequencies upon the selenium, and the latter gives a musical note corresponding to each dot, even when the beams of light overlap on to the same portion of the selenium. When that occurs with [illegible] they are heard, just as they are when [illegible] piano are struck together.

The selenium bridges used have a [illegible] several megohms and require about 1,000 [illegible] results. The telephones used were a pair [illegible] each. Since type of any size whatever can be put into the shape of a white-on-black transparency by means of photography, and simultaneously reduced to the proper size, the reading of type by [illegible] is now reduced to a matter of photography. [illegible] successfully read so far is an inch [illegible] white as a transparency. But it is [illegible] The two vertical strokes of *H* or *M* give a [illegible] the middle stroke of *E* gives a chord, and the curved lines of *O* and *S* give characteristic [illegible] Dr. Fournier d'Albe states that the alphabet of capital letters can be learnt in about an hour, [illegible] the sounds are learnt, the process of reading [illegible] as rapid as that of reading by sight.

As an interesting development it has been found possible to design transparencies which will give any required musical note, and a number of musical compositions have been transcribed in this manner. The notes so produced are particularly clear and free from overtones and a "musical optophone" fitted with a keyboard has been constructed.

But it is obvious that the chief desideratum is that ordinary black-on-white type, printed on paper, should be read optophonically. Experiments which have been made in this direction are very encouraging. A strip of slate long enough to cover the line of dots was cut and perforated with holes so as to let the upper ends of the glass rods project just beyond its surface. The slate was covered with selenium and sensitized. A glass plate was laid over the wooden "reading desk" and the glass rods, and a printed advertisement of large type was placed face downward on the glass. The white paper produced a chaos of all the notes, which broke up into more or less well defined notes as the black letters were passed over the rods. But the loudness and distinctness so obtainable were greatly inferior to what they are by transmitted light. Still, the solution is there in principle, and it is only a matter of making the type smaller and the effects louder and more distinct. The blind will then be able to read everything as well as the sighted.

The Current Supplement

THE current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2028, for November 14th, contains the second and concluding instalment of a most interesting article telling how to collect and preserve insects that will be greatly appreciated by every amateur who indulges in this pursuit, as it gives, and illustrates, the best methods followed by scientific collectors. The measurement of radioactivity constitutes a sensitive method of chemical analysis for substances containing quantities too small to be detected by the spectroscope, and the description of the construction and operation of an instrument by which direct measurements can be taken will interest both the physicist and the electrician alike, as it can be also employed as a delicate electrometer. An article on radium therapy reviews the results of the use of radium for the treatment of a great number of diseases at the London Radium Institute, and gives a definite basis for judging the powers of this new and wonderful agent. The causes of erosive effects on canal bottoms by power vessels is discussed in a concise article, which is profusely illustrated by *photographs of the actual tank experiments.* A timely article is that which deals with the engines used by France and Germany in their submarines. Another summarises the preventive measures taken in different countries to protect their armies against typhoid, which is now prevalent at the seat of the war. An experiment in organic education tells about a rational attempt to fit the course of study to the child, instead of trying to fit every child to the same fixed course. In the article on the design of floats for hydro-aeroplanes the technical scientist will find an exhaustive article on this complex subject. Street sprinkling by trolley cars as it is done abroad, is described in another note, and there are articles describing a direct reading psychrometer and regulating storage batteries from a distance.

New Economic Type of Electric Power Distribution for Small Consumers

A RATHER original proposal, calculated to bring the use of electricity still more within the reach of the small consumer than is the case at the present day, is due to a German engineer, K. Schmidt, according to *Prometheus*. The new system proposes to make use of a small transformer by means of which the current is stepped down to about 80 volts. It is then feasible to use inexpensive bare wire conductors and low voltage lamps of 10 to 25 candle-power, which can be made and used very economically.

Correspondence

The Editor is not responsible for statements made in this correspondence columns. Anonymous communications will not be considered, but the names of correspondents will be withheld when so desired.

Substances for Paint

To the Editor of the SCIENTIFIC AMERICAN:

In your issue dated September 26th, 1914, you published your issue dated September 26th, 1914, an article entitled "Substances for Paint," wherein you made the following statement:

"Owing to the extensive use of graphite for many purposes the natural product no longer suffices, but fortunately the new electric furnace processes come in to make up the deficiency."

We beg to say that the author has rather inadvertently made a misstatement, as the graphite which we supply to the trade from an inexhaustible deposit is very largely used in the manufacture of paint not only by ourselves but a great many paint manufacturers who purchase it from us, and this Mexican graphite is amorphous in character and very pure, analyzing 85 to 90 per cent graphitic carbon.

THE UNITED STATES GRAPHITE COMPANY.
H. C. WOODRUFF, General Manager.
Saginaw, Mich.

Germany's Big Siege Guns

To the Editor of the SCIENTIFIC AMERICAN:

Having just returned from Germany on board the steamship "Rotterdam," after having left New York on September 1st on board the steamship "Noordam," I notice in your valuable paper, under date of the 17th ultimo, a statement to the effect that the continued rumors about Germany's using siege guns of 42 centimeter have no foundation, and that the largest siege guns used by Germany have 28-centimeter caliber.

I beg to correct your statement. The German "siege artillery" is using siege guns of 21, 28, 32, and 42-centimeter caliber. The 42-centimeter gun throws a shell one meter in length and of 1,705 pounds weight. The carrying distance is well over 15 miles. Two of those 42-centimeter guns were stationed at the village Lierre, about 10 miles from the forts of the inner line of fortifications of Antwerp. I could hear their firing at a distance of over 45 miles at the Dutch port of Vlissingen (Flushing). These guns have to be transported by rail and are not mounted upon caterpillar wheels like the 28-centimeter mortar of the German army, nor are they transported in two parts like the 32-centimeter Austrian mortars. The rails for their transportation are specially laid to a base of re-enforced concrete, upon which the gun carriage rests during the firing.

The 42-centimeter gun is attended to by engineers of the Fried. Krupp'sche Gussstahl Fabrik, Essen, who have been appointed officers by special command. The firing is done electrically at a distance of over 100 meters, and nobody is allowed within a radius of 100 meters until after the discharge of the gun.

The designers responsible for these 42-centimeter guns have received the Iron Cross.

There are only 7 or 8 of these guns in operation. At the time of my visit at Essen, the last week of September, 1914, several more were building, as also a small number of 52-centimeter guns, built especially for firing across the English Channel. JOSEPH SCHAEFFERS.
Cleveland, Ohio.

[If Krupps are building any 52-centimeter guns, they are not intended for firing across the English Channel; for the distance (over 20 miles) would prevent any observation and correction of the fall of the shots. They would be used to keep the British fleet at a great distance from any ports which Germany may be able to capture and convert into submarine bases on the Belgian and French coasts.—EDITOR.]

Protective Coloring for Aeroplanes

To the Editor of the SCIENTIFIC AMERICAN:

The extensive use made of aeroplanes for reconnaissance in the present war recalls to mind some investigations which I made last spring (with the practical assistance of a small boy in the neighborhood) on the visibility of light blue colored kites in the air.

My rough experiments seemed to indicate that an aeroplane colored a trifle darker blue than that of the sky would be practically invisible at a comparatively low altitude, even against a background of white or gray clouds, especially if it were moving rapidly. Even if it were not entirely invisible, the general outlines would appear so indistinct as to render the accurate determination of the range almost impossible. Of course, the entire machine, including the metal parts and also the clothing of the aviator, would have to be azure blue, and all parts which observation would show to be usually in shadow should be of a lighter shade, in order that the whole present a uniform *sky*-blue color at a distance. To be most effective, the engine should be muffled by a silencer of the Maxim type. The same scheme might be feasible with dirigibles, although it would be much more difficult to produce the illusion of a uniform blue color in so large an object.

I do not know whether any investigation along this line has been attempted before, but if it has not, I believe it is worth the attention of those interested in military aviation. CHARLES PHILLIPS.
Minneapolis, Minn.

The Force It Takes to Stop an Automobile

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of September 19th, Mr. Joseph Livermore arrives at an approximate formula for the least distance in which a motorcar can be stopped by brakes on the hind wheels. As he says, he has not taken into account all the factors that determine this distance, as there is no need for great theoretical exactness. However, I think there is one point of interest not commonly understood when a car is accelerated, in either sense, by the hind wheels. I refer to the shift of pressure from the rear to the front wheels in braking and the converse when driving. The amount is easily calculated.

Let h = height of the center of gravity above the road,
b = the wheel base,
m = the weight of the car,
M = the weight on the hind wheels when the car is at rest,
f = the coefficient of friction between the tires and the road,
a = the acceleration of the car in feet per second.

When there is an acceleration a there is caused a couple of amount $\frac{m}{g} h a$ which tries to turn the machine in one sense. Since the machine does not turn a somerset, there must be an equal couple in the opposite sense acting, which we can express as (loss of weight on wheels) times (wheel base). Thus the loss of weight =

$$\frac{m}{g} \frac{h}{b} a$$

Since the total weight of the car on the road is the same, the other set of wheels must gain a like amount,

$$\frac{m}{g} \frac{h}{b} a$$

Using the diminished pressure on the hind wheels to calculate the force of braking at our command, we find

$$a_m = f\left[M - \frac{m}{g}\frac{h}{b} a\right] \text{ and hence } a = f\frac{M}{m}\left[\frac{1}{1 + f\frac{h}{g b}}\right]$$

This shifting of weight is, of course, of no great importance in ordinary practice, but when a great deal of power is being used, should it not be reckoned with? For instance, when the front wheels of Mariott's Stanley jumped off the ground and wrecked him so badly, it might well have been due to the loss of weight on them caused by the great torque of his engine at 130 or so miles per hour. Again, is not this shift of weight to the front wheels in braking an argument for front wheel brakes (which I understand some foreign cars have already adopted), if only to lessen the "chattering"?

W VAN B ROBERTS.

A Public Phonographic Library

To the Editor of the SCIENTIFIC AMERICAN:

I have been reading a thousand and first article illustrating Mr. Edison's patience in putting new devices on a practical basis; in this instance an account in your journal of a phonographic check for the use of typists.

I am innocently ignorant of all mechanical technicalities and am perhaps too anticipatory, but it *does* appear that my long dream of enjoying a public phonographic library should begin to materialize. It involves simply a first reading of books *into* a standard recorder, the uniform records then to be shelved in lieu of books, or along with them in the library or "phonorium," as I shall name it at a hazard, to be taken down at liberty and inserted in the reproducing devices, arranged centrally along the tables, and provided with antiseptic ear-pieces. Or the records could be heard by groups of persons by means of machines provided with megaphones in small side rooms, or be lent for use, at the homes of the subscribers.

I understand there is a method whereby a wire or band of indefinite length has been made to reproduce words; but should this not be practical, I see no reason why a series of very thin disks could not be inserted, in order, with but little more trouble than the turning of pages, the order of the disks being maintained by folding them back over a loose ring or cord at one side, in the manner of a book. Possibly such a portfolio could be even rolled upon itself to a degree and carried about quite as conveniently as a book. Such records might be made by any clear reader, and the saving of both time and eyesight to the hearers would be considerable, the process of *hearing* words being indeed infinitely more natural than *seeing* them. It would be a peculiar boon to the blind, and in a less degree to slow readers, like myself, who find it possible and very enjoyable to listen to a book being read, perhaps twice as rapidly as they could read it themselves.

We can only dimly fancy the thrill of hearing Shakespeare read one of his sonnets; but with our writers their reading for the future depends only upon a *literary* development of a phonograph that already obtains largely as related to music. Indeed, it would be more plausible to develop a *talking machine* before a *singing* one, as the latter demands primarily a perfection of tone, a matter in which success is still remote, while in the former this is a somewhat secondary matter; yet who would not consider the sense of the author's personality in the reader's favorite novel almost doubled if he were permitted to hear, say, the author himself quietly reading the book?

There is already on the market a phono-post card, doubtless a toy, but which suggests a possibility of correspondence by means of disks or reels, compared with which the refinements of the present devices as described by Mr. Wade would seem to be tediously slow and cumbersome.

My purpose in addressing the SCIENTIFIC AMERICAN is the hope that it may stimulate the interest of some inventive mind in a department of phonographs that has, I believe, been neglected. C. P. CALDER.
Philadelphia, Pa.

Ocean Fog Signals

To the Editor of the SCIENTIFIC AMERICAN:

Permit me to add to the observations concerning ocean fog signals contained in my letter printed in the SCIENTIFIC AMERICAN for July 4th, 1914. There are many ships which are not equipped with wireless apparatus. These could not make use of a system of signals such as I outlined. I believe a system of sound signals alone, for such ships, is practicable. At present the whistles are blown *or the fog horns are sounded at* more or less regular intervals, but neither whistle or fog horn is so arranged as to convey any definite information as to distance, or direction of movement of ships. A mechanical contrivance could be perfected that would, by the pressure of an electric button, sound the whistle or the fog horn, and also record the exact time. The time-recording apparatus could include a traveling ribbon similar to the stock ticker. This ribbon could be *set to travel, say, one inch per second*. This would show 1,100 feet of distance for each inch of traveling ribbon.

Now suppose two ships equipped with these devices. One ship sounds its whistle or fog horn. Instantly upon receipt of this sound wave, the button on the other ship is pushed. When the first ship receives the return sound wave, one half the distance traveled by the ribbon will indicate the distance between the ships. Here is the formula. A ship sounds whistle or fog horn, at the same time making a dot or dash upon the traveling ribbon. The ribbon travels twenty inches before the sound returns. That means that the ships are 10 times 1,100 feet apart, or about two miles. If the ships are approaching each other, after a little the ribbon will record, say, sixteen inches. That means that the ships are 8 times 1,100 feet apart. As the ships move away from each other the ribbon will run further during the *round trip of sound*. After three or four round trips of sound a general idea of the speed and direction of each ship would be conveyed. The record of each ship would be the same, as a dot or dash would be recorded upon the ribbon simultaneously with the answering blast. The records would soon show about how far away the companion ship is, whether it is approaching or receding, and at about what speed.

Two incidental matters suggest themselves. In case of ships where there is no equipment of traveling ribbon, a good stop watch, accurately manipulated, would be a fairly accurate substitute. Where a wind is blowing hard enough to interfere with sound travel, the fact that the distance is averaged upon a round trip basis would seem to equalize, somewhat, this problem. If the wind retards in one direction it will accelerate in the other direction. I am well aware that there are other difficulties in the way of the successful use of sound to locate the position of ships in a fog. But there are difficulties in the way of every real improvement. Some time the fog problem will be overcome. I believe it will be overcome through some system of sound signals and automatic time records. Therefore, I offer my suggestions with the hope that there may be some hint in them that may help those who are working along this line.

Syracuse, N. Y. J. B. WEST

Utilizing Vacuum Suction in a Carburetor.—In a patent, No. 1,108,181, to Edmund J. Kane, of Chicago, assignor to International Harvester Corporation, is provided a carburetor having an air passage way with associated fuel and water inlets and in which is localized a vacuum caused by the suction of an engine around such inlets in accordance with working conditions to make the operations of the engine economical under all conditions.

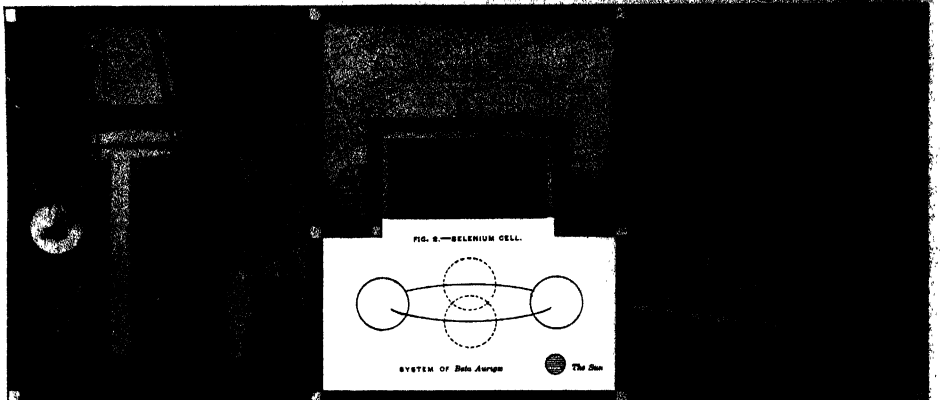


FIG. 1.—SELENIUM PHOTOMETER IN AN ICE PACK ATTACHED TO TELESCOPE. THE CONNECTING WIRES LEAD TO THE GALVANOMETER SHOWN IN FIG. 4

FIG. 2.—SYSTEM OF BETA AURIGAE AS VIEWED FROM THE EARTH. DOTTED CIRCLES SHOW ECLIPSE POSITION.

FIG. 4.—GALVANOMETER AND ACCESSORIES USED WITH SELENIUM PHOTOMETER.

The Electrical Measurement of Star Light

How Modern Technical Advances are Utilized in Astronomy

By Joel Stebbins, Professor of Astronomy in the University of Illinois

ALTHOUGH astronomers have studied the stars since the time of the Chaldeans, it is less than a century since any exact measures have been made of the amount of light which comes to us from even the more conspicuous heavenly bodies. There would seem to be very little scientific importance in the measurement of the candle-power of one of the little points of light in the sky, and there is not much of special interest unless that star happens to fluctuate in light. If we should find that the stars, as a rule, are all growing fainter and dying out, it would be a natural conclusion that our sun, which is only one of millions of stars, is likewise diminishing in splendor, and the future of the earth is of course wrapped up in the maintenance of the sun's light and heat. As a matter of fact, it is found that many of the stars do change in light periodically, some according to definite laws, and others quite irregularly and in a fashion which cannot be predicted. There is a certain class of these objects which, in the course of something like a year, vary one thousandfold, or even more.

The most natural instrument for the measurement of the light of stars is, of course, the human eye, which with all its drawbacks and peculiarities remains unapproached as an instrument of general adaptability. To illustrate the enormous range of usefulness of the eye, let us consider that if another sun were placed near our own, we could look at the two bodies, with difficulty to be sure, and estimate roughly which would be the brighter. Likewise we can compare the light given by two of the faintest stars visible on a dark night without an instrument. The ratio of the sun's light to that of one of these stars is ten million million, and the eye can be used for objects of all intermediate grades of brightness. It is as though we should compare two sounds at a distance of ten feet, and then move them to 6,000 miles and compare again, or as if we could use a balance for weighing a grain of sand and also a large ocean liner. Surely, for general purposes the eye is unsurpassed, but for accuracy the unaided eye does not come up to the standard of many instruments. In the estimates of intensity of lights as faint as the stars, visual observations are often in error 10 per cent, 20 per cent, or even more, and no photometer or instrument has been devised which will reduce the errors introduced by the eye to 1 per cent.

Photographic Measurements of Star Light.

Another method of measuring the light of stars is to take a photograph of a region of the sky and then measure the star images on the resulting negative. In this case there is the additional advantage of the permanent record of the plate, which is quite independent of the condition of the observer and the time of exposure, a point by no means to be ignored on a cold winter's night. Since the introduction of the dry plate there has grown up a whole field of photographic photometry of stars, and many of the most striking results are obtained by this method. Nevertheless, the photographs have errors of their own, due principally to the non-uniformity of the sensitive film, and astronomers have been looking for some other means of increasing the accuracy of the results.

In these days of mechanical and electrical wonders, even an astronomer may be behind the times if he looks through a telescope instead of letting a machine do the work, and such a problem as measuring the light of stars may call in the aid of electricity for its solution. At present there are two or three methods being developed whereby the light of a star is converted into an electrical effect, and in this way a measure is made. The first method which has led to results depends upon the peculiar properties of the element selenium. This substance is much like sulphur in its chemical action, and like sulphur, exists in several allotropic forms. It has been known for many years that the crystalline form of selenium changes its electrical resistance when exposed to light, and various attempts have been made to utilize this property as a principle in some photometer. The idea is attractive and very simple. Let a 16 candle-power lamp be placed at a given distance from a selenium instrument. Exposure to this light will change the resistance of the selenium, which may be measured with a galvanometer. Let the apparatus be arranged so that the scale reading is 16 for such a lamp, 10 for a 10 candle-power lamp, and readings for other lights in proportion. Imagine the change in the lighting industry if a householder could test the candle-power of his lamps with the same ease and certainty that volts and amperes are now determined! However, the combined efforts of many experimenters have not produced such an instrument, principally because of the idiosyncrasies of selenium. In the first place, this element is usually sensitive only to red light, and the results are not directly comparable with those of the eye, as the latter is affected by all of the colors which make up white light, the maximum visual effect being in the yellow. But worst of all, light-sensitive selenium is peculiarly unstable and erratic in its behavior, and no experimenter has ever solved to his own satisfaction the mysteries of this substance.

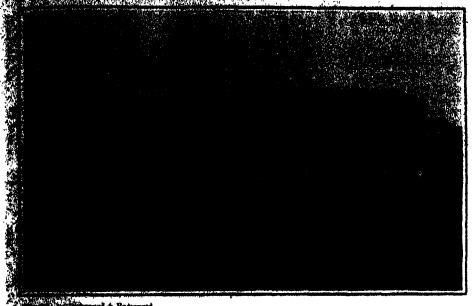
In Fig. 2 is shown a selenium cell of the usual form, made by Giltay of Delft, Holland, whose product is far superior to that of any other maker at the present time. Two wires are wound in a double spiral about a flat insulator, and the spaces on one face are filled with selenium which is afterward sensitised. The expression "selenium cell" is a misnomer, as the arrangement is simply a resistance or "bridge," the selenium elements being connected in parallel and the two wires are brought out at the back of the case. The exact method as used by Giltay for treating the selenium is a trade secret, but one way is to heat the cell to about 217 deg. Cent. (423 deg. Fahr.), when the selenium melts, and then let the crystals form during slow cooling. As a matter of fact, the best procedure is a secret to everyone who has ever tried it, as a half dozen cells, all made together in exactly the same way and annealed side by side in the oven, will show great variations in quality, usually most of them bad. A good cell of this character has a surprisingly high resistance, about 1,000,000 ohms in the dark, but exposure to strong daylight will reduce this to 20,000 ohms, about fifty times smaller. After such a decrease, however, the cell will require a whole day in the dark to recover its original condition and sensibility.

Using the Selenium Cell.

In the application of the selenium method to the stars, since we are concerned chiefly with variations of light intensity, it is immaterial whether the instrument is sensitive to the red or not; the main thing is to get rid of the irregularities of the selenium. Here it has been found that the temperature should be low as well as uniform, and, strange as it may seem, the power of a telescope is greatly increased if the selenium is surrounded with an ice-pack. It is literally true that this arrangement increases the effective sensibility of the apparatus one hundred-fold over what it would be in the summer months if the ice were not used. Fig. 1 shows such an ice-pack at the end of the telescope of 12 inches aperture at the University of Illinois Observatory. Wires lead in conduit from the photometer on the moving end of the telescope to a galvanometer on a solid pier in an adjacent room, Fig. 4. Two observers are of course necessary, one to point the telescope and expose the selenium to a star at the focus of the large lens, and the other to read the galvanometer and record the measures. On fairly bright stars, the selenium photometer gives results accurate to something less than 1 per cent, but not yet to the tenth of a per cent which astronomers would like to have.

It would lead us too far afield to describe in detail some of the recent results in other lines of astronomy, but there is one product of spectrum analysis which is of special interest here. Peculiar changes in the spectrum lines of various stars can be explained only by the proximity of large planets or companion stars comparable in size with the main bodies. In fact, four out of five of all the stars thus far tested with the spectroscope show this peculiarity, and it may ultimately be found that the star which exists by itself is the exception. Our sun has a family of relatively small planets, the nearest, Mercury, requiring eighty-eight days to revolve in its orbit; but among the more close of double stars are found many systems where the time

(Concluded on page 416)



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A view of Fort Erbrandt, part of the Antwerp defenses, blown up by the Belgians before they left.



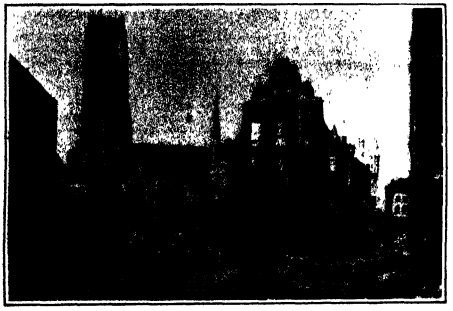
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Fort Starbrouck after its destruction by the Belgians to prevent its falling into German hands when Antwerp was taken.



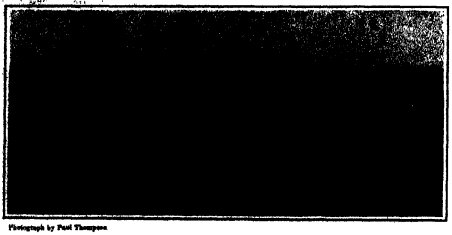
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The façade of the Royal Courts of Justice in Brussels, showing the German sandbag defenses prepared for an emergency.



Photograph by Underwood & Underwood

A public square in Malines after the second German bombardment. The terrible effect of modern shell fire is only too apparent.



Photograph by Paul Thompson

An English armored motor car conveying an aeroplane.



Photograph by Paul Thompson

One of the rotary cupolas of Maubeuge. The shell of a German siege gun evidently blew off the roof after penetrating the wall armor.



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A company of Turkish infantry. These men have been trained chiefly by German officers.

PICTURES FROM THE FRONT

Strategic Moves of the War

Letter from the Military Correspondent of the Scientific American, November 7th, 1914

The French Campaign.

THROUGHOUT the week the Allies have maintained their general policy of a defensive campaign. They are evidently waiting for a further development of their military strength before they adopt the aggressive tactics that alone can give them victories. Their defense is, however, an active one, in that they deliver counter blows whenever an opportunity offers.

This war is undoubtedly going to last for many months. The Allies have no idea of giving in to the German demands, while the latter are unlikely to make concessions when the fighting is in their favor. If the contest becomes one of endurance the present tactics of the Allies in the west should prove very much to their advantage. The German assaults are enormously expensive in lives, and involve losses probably twice as great as those of the defenders. When the attacks are successful, the assailants compensate for their killed and wounded by subjecting the fleeing troops to much larger losses, increased by the stragglers and the captives. The Germans in the recent fighting have suffered the disadvantage of the attack without the compensating advantage of the pursuit.

The Allies have made local aggressive moves, however, in three districts. In the north they have endeavored to handicap the German campaign against Dunkirk by pushing forward a salient beyond Ypres that threatens to take in flank any advance either to its north or to its south. As long as the Allies can maintain this position they can prevent any serious progress of the Germans toward their objective on the coast.

In the Woevre district, southeast of Verdun, the French have been making strenuous effort to dislodge the Germans from their position on the Meuse River at St. Mihiel. Their army from Verdun has pushed eastward fifteen miles from the river, while an army from Toul has attempted to advance northward so as to cut in behind the German salient. The Germans have been able so far to hold back both forces sufficiently to maintain their possession of this breach in the Meuse fortified line and of the bridge over the river.

In Alsace the French have also made an advance and have recaptured Altkirch. This city in the number of times that it has changed hands during the war bids fair to rival the record in the civil war of Winchester in the Shenandoah Valley of Virginia, which in the advance and retreat of the various campaigns was captured or recaptured more than ten times. This Alsatian move of the Allies seems so far due rather to a weakening of the German defensive force rather than to any determined effort of the French to make a strategic move by way of the Rhine against the German flank.

The Germans are now confronted with the need of making some serious inroad upon their opponents' armies, while they still hold the advantage due to their better preparation for the war. Both in the east and in the west the Allies have attained such strength in the field that the Germans can no longer hope to be superior in both theaters of operation. They must sacrifice one campaign in order to secure hopes of success in the other

At present they seem to have weakened their campaign in Russia, while they have not yet developed on the western front the blow that they must deliver if they hope to break through the line of the Allies. Vigorous attacks have been made at various points, but no advance has yet been pushed in the strength that would indicate an aggressive move involving all of the German forces in the west

The campaign to push forward the German line along the North Sea coast has been carried on as a more or less local fight, extending over the 60-mile front from Arras to the sea. The German attacks between Dixmude and the sea were hard pressed and secured for them a foothold on the west bank of the Yser River at the beginning of the week Abont 15,000 men crossed and captured the Belgian trenches along the river bank. The advance, however, led them into a Belgian trap, for the water in the lower stretches of the river is higher than the surrounding country, and is held back only by dikes or levees along the banks. When the Germans had pushed forward into the low grounds the Belgians cut the dikes and isolated those troops that were not overwhelmed by the flood. The German efforts to reach Dunkirk by this route have then ended in disaster.

Vigorous attacks were also made along all of the line from Dixmude to Arras, but the censored reports do not show in what strength Most of them were certainly demonstrations made to deceive the adversary. Opposite Ypres and La Bassée, however, there seem to have been determined efforts by the Germans to break through after the failure of their campaign north of Dixmude.

Throughout all of the rest of their line in France the Germans have been content merely to bombard the enemy's line and to make sufficient minor attacks or reconnaissances in force to feel out the hostile positions and to insure the retention of full strength in the opposing troops.

The Russian Campaign.

The fighting in Russia has now developed to an extent that makes it rival in interest that in France. The opposing armies are now lined up on a continuous front extending from the Carpathian Mountains for 900 miles to the Vistula River, near Wloclawek in Poland. Along the East Prussian border there is another battle that is separated by 120 miles from the fighting west of Warsaw, but which must, nevertheless, be considered part of the general battle on account of its immediate influence upon the rest of the campaign.

The German aggressive campaign ended with the check at the Vistula River. Since then the Russians have been forcing the fighting. Their strategy is excellent and worthy of more than a passing glance.

When the German invasion from Silesia first developed in force, the Russians had an equal force along the Vistula with which to stop them. They took no chances, however, and called in troops from every direction, even at the expense of abandoning captured territory. When everything was prepared and their superior strength was assured, they turned loose their armies on the Austro-German line.

The German north flank was attacked in front opposite Warsaw, while an army from Novo Georgievsk threatened its flank. This same move was repeated at each successive position occupied by the Germans until the latter were driven back to the line of the Warta River, three quarters of the way to the border. The latest news from Petrograd claims that the Russians have now captured a part of this line at Kolo, 100 miles west of Warsaw.

This success of the Russians west of Warsaw exposed the German line farther to the south to attacks from two directions and forced this portion also to retreat to the west. The Russians crossed the Vistula and pressed their attacks upon the Austro-German lines until they have been forced back to Przedbors, Kielce, and Sandomierz. The Russians are now making great efforts to break down the resistance of this part of the opposing line. A victory here would threaten the flank of the Austrian line in Galicia and would give the Russians a chance to repeat the same moves that in September forced the Austrians to retreat to Tarnow.

The line of fighting in Galicia follows the San River to Przemysl and then strikes south through Chyrow and Stary Sambor to Turka, in the foothills of the Carpathians On this wing the Russians have been fighting on the defensive while massing their troops to support the aggressive moves in the north. While the Austrians have made attacks at Lelzaisk, Jaroslav, Przemysl, Stary Sambor, and Turka, they have been repulsed without result on the relative positions occupied by the troops. The fighting in this theater is somewhat like that along the center of the line in France, a deadlock while waiting for the outcome of the conflict in other parts of the battle area.

The fighting in East Prussia has been like that in Galicia. The Russians have, until the last few days, contented themselves with a defensive campaign. They are now taking advantage of the weakening of the German strength to press back this part of the German line also.

The noteworthy fact of the fighting in this whole theater of operations is the demonstration by the Russians of their ability to force the Germans to retreat. Neither side has yet suffered a serious disaster. The Germans and Austrians have retreated in time to save the fighting strength of their armies.

Random Reflections

By "Irresponsible"

COURAGEOUS, free, sincere thinking is the very breath of science. No other kind of intellectual activity has achieved such entirely untrammeled freedom. The scientific man recks nothing of the shibboleths which hamper the artist; his choice of problems and his choice of treatment is never open to the enervating classification which labels a thing pleasant or unpleasant. He is quite outside that point of view. A detailed analysis of tumors is not labeled unpleasant, and a detailed analysis of spectra is not labeled pleasant. Applied to scientific work that method of classification is seen to be irrelevant. It is interesting to note the reason for this, and it will then dawn upon one, I think, that the method is almost equally irrelevant when applied to works of art, especially modern art.

But there have been people who have applied this kind of criticism to science itself. A clerical gentleman once pointed out to Huxley that the theory of evolution, applied to man, was degrading and offensive. Huxley replied that his opponent had slightly misunderstood the point at issue; the doctrine might be unpleasant, but was it true? There are these two types of mind, those who seek for truth, and those who apply the joy criterion and reject all ideas which don't taste nice. The jam school has a lot more to say for itself in matters of art than in matters of science, partly because most scientific theories affect its palate neither pleasantly nor unpleasantly, but have a sort of neutral taste. Another reason is, that by sticking to provable facts instead of adopting pleasant imaginings, science has made good, and made good on such a scale that, although the jam philosophers may and do occasionally rail, they dare not attack. It is true there are some gentlemen who take it as a personal slight that the planet earth is small, and that even the sun is by no means the boss star of the universe. But they comfort themselves by reflecting that mind is mightier than matter, and they imply, although their modesty usually forbids them explicitly to state, that their own minds are rather better class products than any others which are likely to have been evolved in our particular universe of about five hundred million stars.

Now I think these people are in the majority and I think that is a very bad thing. I think that a country most of whose citizens are engaged in manufacturing and consuming jam is in a bad way, even if the jam making is a source of great material prosperity. Henri Poincaré starts one of his books with the remark that the chief aim of man is to search for truth. Nine people out of ten will tell you that the chief end is to search for happiness. These are the two points of view and they split up the whole world into two kinds of people.

Most artists and men of science belong to the truth seekers and most business men belong to the happiness seekers. The second school values science for its useful applications and art for what agreeable amusement it provides. For the benefit of the devotees of happiness, presidents of the British Association make long speeches pointing out that pure mathematics, for instance, really is of some use, and that electric trams might go two miles an hour slower had it not been for some patient individual who spent an absorbed lifetime finding out how many little circles could be fitted inside a big one. Such speeches are quite unnecessary: science needs no such justification. As Poincaré points out, we have an instinct to *know*; so we proceed to find out. I feel hungry; so I eat. I don't bother to point out that by eating I add to my physical and mental efficiency, prolong my life, and continue to benefit the world by writing more columns for the SCIENTIFIC AMERICAN. I might even have difficulty in justifying my eating from that point of view; there may be people who doubt the usefulness of my activities, who think that my articles —still, we don't want to go into that.

Now, just as it is incorrect to measure science by the pint pot of pleasure, so it is, I think, incorrect to measure works of art by that standard. The problem is rather more complicated, because beauty should be an essential of art, and beauty is an extremely difficult thing to define. But literary critics of the jam school don't mean that a piece of literature is unbeautiful when they say it is unpleasant; they mean merely that things are described which make them uncomfortable. Perhaps a character in the book reminds the critic of a man who lent him $50 and expects it back; an uncomfortable thing for a professional literary critic. How often one hears the remark: "I don't know anything about art as art, but I know what I like." This is all very well for the business man coming home tired from a busy day spent in supplying railway buffets with hard-boiled eggs, or for a successful play-producer interviewing the young and nervously perspiring dramatist who has incautiously let drop the word "art," but a professed critic with that attitude is a sham unfit for his job. If a work of art is vivid, moving, beautiful, it is all right; and it is equally all right whether it be a grim, realistic study of life on a leper island, or whether it be an affecting account of two sweet children talking sentiment about their daddy in heaven. Both could be well done. I should prefer the leper island—it's more original, for one thing, but I hope I could praise the sweet children.

A Museum of Devices for the Elimination of Unnecessary Fatigue in the Industries

By Frank B. Gilbreth

BEFORE the breaking out of the European war this age might well have prided itself upon being an age of waste elimination. For a time the emphasis was all upon cutting down waste of material; but lately the emphasis has been shifted to the human element, and such phrases as "Safety First" have become the slogans of the day.

With this consideration of the human element has come the realization of the importance of fatigue, and the necessity of allowing the worker all possible opportunities to recuperate from it. Provision for such recuperation is the basis of most welfare work, which consists of providing rest rooms and lunch rooms, social halls or other places of amusement, where the worker can go before working hours, during his noon hour or afterward, to relax physically and mentally, and to get back his working strength.

In the majority of places to-day, however, it has not been recognized that fatigue is of two kinds. A certain amount of fatigue is necessary fatigue, which the very nature of the work done demands, and which can be excellently dealt with through such devices as are provided by welfare work, or by the home reading box movement and other plans of scientific management. But a large amount of the fatigue accumulated in the average day's work is entirely unnecessary, and is caused by such perfectly obvious, but often unnoted conditions, as wrong lighting or heating or ventilation, vibration, standing instead of sitting, or working at machines or benches, and on chairs or stools which are of the wrong height.

Ask any manufacturer to walk through his plant and spend a half day himself making a fatigue survey; that is, deciding just what fatigue the work done in his plant is causing, and what proportion of it is actually necessary or productive. Ask him to count how many fatigue eliminating devices he has, and to find, if he can, in how many places a study of fatigue elimination has been made. The result will astound him and you.

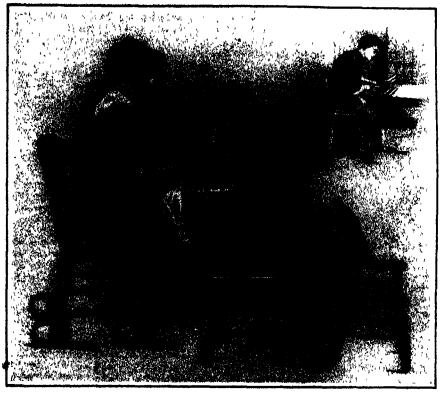
In order to bring this subject of unnecessary fatigue to popular attention, we have started, in Providence, R. I., a Museum of Devices for the Elimination of Unnecessary Fatigue. This consists, at present, of but half a dozen simple devices, all but two of which have come from our own work, in spite of the fact that we have sent out tens of thousands of letters, asking for co-operation in this work. It is not that co-operation is lacking, but simply that so few such devices exist; for we have received many replies, stating, "We would gladly send such devices, if we had any, but we have never given the matter any thought."

Interest in this museum is bound to grow during this coming year, because all of the members of the second summer course of scientific management, which we conducted at Providence this summer, have promised to start museums of the same kind at their colleges. Within the last few weeks we have received letters from the three professors who came from one of the colleges to attend the course, that they have begun active steps to start their museum by appropriating money enough for the beginning, and that they felt sure that interest in it would extend throughout the entire State which they represent. This is encouraging news. The colleges have thus shown themselves ready and willing to lead the way, but extended interest and rapid progress depend much upon enlisting the co-operation of the industrial world.

Now the average American manufacturer is not only beginning to install all devices which will increase production, but he has, especially of late years, a strong realization of the importance of the human element; and certainly, as soon as he comes to think in terms of the elimination of unnecessary fatigue, our collection of devices will grow rapidly.

One of the most obvious devices for eliminating fatigue is the chair; and, if you come to Providence or visit any of the factories where the devices there exhibited are installed, you will find that the first rule followed is "A chair for every worker, whether he needs it or not."

Fatigue eliminating chairs are of various types, some



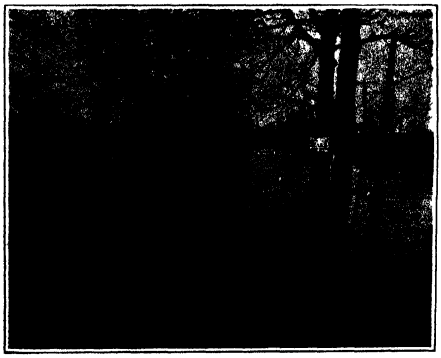
Chairs designed to eliminate fatigue.

of which are shown in the accompanying illustration. One type is devised in order that a kind of work which has always been done standing, may be done sitting. For example, heavy filing, which has always been considered standing work, may, through the use of a specially devised chair, be done with greater ease and the same speed and efficiency, while the worker is sitting. The chair is most inexpensive and easy of construction; is provided with a projecting foot rest, which enables the man to push the file as comfortably, sitting, as when he stands up; and is of such a height that the man can work part of the time standing and part of the time sitting.

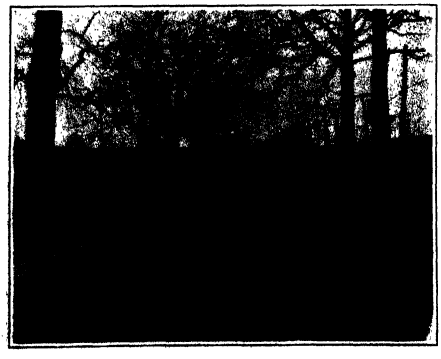
Another type of chair illustrated is specially devised to permit the worker to stand part of the time at work which has usually been done sitting. It is useful in rest intervals. For example, in a certain industry where cotton cloth is folded, the hour is divided into a number of work periods and rest periods, which alternate—four periods of work to one of rest, with a longer rest period at the end of the hour. During certain of these periods, the worker sits, during others, she stands. This type of chair allows her to go from the sitting to the standing period in the quickest time, and with the least amount of effort possible, and, incidentally, has proven itself so comfortable that the worker who has once been supplied with one considers it her personal property, and refuses thereafter to give it up. A third type of chair is a modification of a chair that is already in use, so that it will be the most efficient device possible for the worker using it. Many chairs, which are originally well adapted to the work and the user of the chair, become so worn in time, that the chair is neither comfortable nor useful. In this case, often, such an inexpensive and easy remedy as boring out four blocks of wood and fitting them to the legs of the chair will bring the chair back to its originally desired height.

A fourth type of chair, which will cut down fatigue, is one which eliminates unnecessary vibrations. An ordinary chair, which has shown itself useful and comfortable, may be provided with springs which relieve the operator of 100 per cent of the vibration of the floor, where the type of work done makes such floor vibration necessary. In a certain factory where such non-vibration chairs were introduced, the operators, at first, did not like them; but in at least one case, a girl who had been given this type of chair, and who was later put, for one day, back on the old kind, was so much affected by the vibration that she went home, at the end of a half day, sick.

A fatigue eliminating device is not necessarily a chair. It may well be some sort of a packet, which will bring the goods to be fabricated or assembled closer to the hand of the worker. It may be some sort of chute to carry off the finished product. But the chair is typical of the devices exhibited in and advocated by this little museum, for it emphasizes, not so much increased production, as decreased fatigue.



Road along the Connecticut River, swept by a flood.



The same spot ten days later, showing the road undamaged.

A Flood-proof Road

WATER is a great enemy to all pavements, whether it permeates through the soil under the pavement or directly through the pores of the surface. Of course the more porous the road surface the greater the effect of the water. Even excessive sprinkling that keeps the road continually in a wet or muddy condition, is injurious. Evidently, then, no more severe test can be imposed upon a road than to have it swept periodically by a flood.

The road that runs from Middletown to Cromwell, Connecticut, parallels the Connecticut River. In the spring time the floods that come down the river sweep over this road, submerging sections of it to a considerable depth. One would expect the macadam to be seriously damaged, but, in 1912, it was laid with a surfacing that is proof against such harsh treatment.

One of our photographs was taken on April 23rd last, showing the road deeply covered with the waters of the Connecticut. A similar flood was experienced in 1913. The other photograph was taken from the same spot on May 2nd, 1914, showing the road to be absolutely free from injury. No repairs were required after either flood.

A Windshield for the Motorcycle

AIR displacement of over thirty miles per hour is spoken of as a high wind, of over forty miles per hour as a gale, and of over sixty miles per hour as a hurricane.

The speed of a motorcycle varies, of course, with the condition of the road, the capacity of the machine and the speed mania of the rider; but a rate under 25 miles per hour may be considered rather slow, and the average velocity on good roads will be found somewhere between thirty and forty miles per hour. Hence the average rider, even in still air, must face a wind so high as almost to assume the proportions of a gale, and if in addition to his displacement over the road there be an opposite displacement of the air with respect to the road (in other words a head wind), the rider may experience the sensation of cleaving a hurricane. Even in the best of weather this is discomforting; but in winter the chilling effect of such a blast may produce much suffering; the lower limbs of the rider, in particular, are apt to become numb with the cold. The driver of an automobile encounters just as strong a blast, but he is sheltered by the inclosed body of the car, and usually by a glass windshield as well. Of course one cannot expect to have all the comforts of an automobile on a motorcycle, but it would seem a simple matter to rig up a windshield of light construction on the two-wheeled car, which would protect the rider from chilling blasts.

The accompanying photographs illustrate a simple type of motorcycle shield, consisting merely of a U-shaped frame clamped to the handlebars and the front fork of the machine. On this is stretched a canvas shield with a semi-circular celluloid window at the top. The shield is not so high that the rider may not look over the top of it, when he so desires. However, when assuming his normal riding posture, he will find that his eyes come on a level with the window in the shield. As an extra protection for the lower limbs, an apron is fastened to the frame of the motorcycle back of the front wheel, and extends below the foot rests. Thus the rider is completely protected by a windshield of such light construction as to add very little weight to the machine.



A windshield for the motorcycle.

Novel Uses for Automobiles

THE accompanying photographs show that an automobile may be made to serve a number of useful purposes aside from that of transportation. The motor vehicle is really a portable power plant which may be brought to the work and then by the use of simple mechanism its power may be employed to drive a machine or tool. Many commercial vehicles are fitted with attachments for such auxiliary work. One of our photographs shows a motor car used by the Boston Water Works which closes the water gates when a main has broken, much faster than it can be done by hand. When a break is reported the repair men dash to the scene as quickly as possible in the emergency car, drive to the shutoff nearest the break, and fit on their couplings as shown in the illustration, then in a few minutes the motor closes the gate. Heretofore it has taken anywhere from thirty to forty minutes to close the largest gates by hand; now they may be closed by the motor of the car in from five to six minutes.

Our other photograph shows a homemade attachment to an automobile, which consists of a sawmill. The motor car has a 15 horse-power engine, to the crankshaft of which a circular saw is geared. A platform or table in front supports the wood as it is fed to the saw. The speed of the saw is governed by controlling the motor from the steering wheel in the usual way. This sawmill on wheels is moved around from place to place, wherever there is a wood-cutting contract. Owing to the rough usage to which it was subjected the rubber tires soon gave way, and the owner has replaced them with wooden tires. As the machine is no longer used for high speed travel, these tires serve the purpose very satisfactorily. When the machine arrives at the wood pile it is turned in the manner shown in the photograph, and then one assistant feeds the wood to the saw, while the other controls the operation of the engine.

A New Explosive

TESTS have lately been made in the mines of the Anaconda Copper Mining Company at Butte, Montana, of a new explosive called sabulite. It is a recent English invention, and is already in use in mines of Australia and New Zealand.

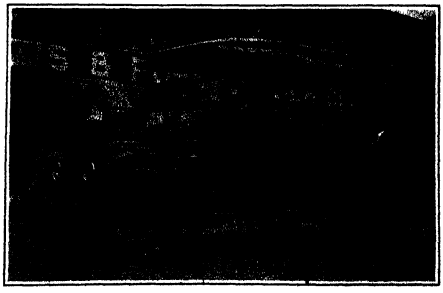
The points of superiority over dynamite claimed for the new explosive are its greater strength, and its safety and freedom from noxious fumes. It is said to be from 30 to 50 per cent more powerful than 45 per cent dynamite, depending upon the age of the dynamite. It cannot be exploded except with a detonating cap, and the products of the explosion are so harmless that workmen can resume work in the face of a closed drift immediately after the blast. It does not freeze, nor deteriorate with age if kept dry. In the Anaconda tests, cartridges of sabulite were burned, bored through with a white-hot iron rod, hammered upon an anvil and shot through with rifle balls without explosion. When used with a detonating cap, however, in a very hard granite face the blasting effect of sabulite was fully equal to that produced by dynamite.

The powder is a simple mechanical mixture of nitrate of ammonia, trinitrotoluol and calcium silicide. The last-named substance is the characteristic ingredient in sabulite. It is a recently discovered product of the electric furnace. It is the comburent element in the powder, and takes the place of the powdered aluminium sometimes used in ammonium nitrate powders. Calcium silicide is a much cheaper commodity than powdered aluminium, besides being stable under ordinary atmospheric conditions. In combination with the other two ingredients, the mixture seems to produce the quick combustion and the high generation of gas necessary for an ideal explosive.

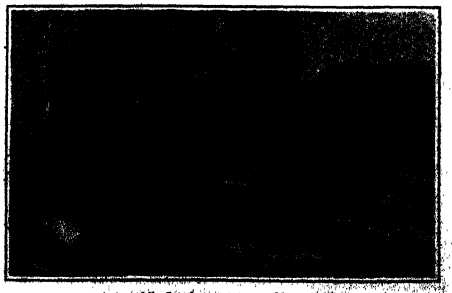
The composition of the gaseous products of the explosion of sabulite bear the following ratio in volume to each other: Water vapor, 0.60; nitrogen, 0.31; hydrogen, 0.02; carbon dioxide, 0.07. The only solid products are silica and lime. An analysis in Australia of the atmosphere of an inclosed gallery immediately after an explosion of sabulite gave the following results: Nitrous fumes, 0.0 per cent; carbon monoxide, 0.0 per cent; carbon dioxide, 0.26 per cent.

Large Air Propeller Boats

THE latest production in the way of gliding boats is the large air propeller craft which Engineer Ch. Roux is running on the Seine. It carries as many as twenty-five persons, and is built for very practical use, it being intended mainly for shallow streams in the colonies where ordinary craft cannot run, aquatic plants being another disadvantage which is not felt by the gliding boat. The body is of steel, 26 feet long and 3 feet wide, the draft being only 10 inches for a two-ton load. A 60 horse-power Rossel gasoline motor of four-cylinder type drives the aerial propeller by chain, it being placed at the extreme after end of the boat. Propeller is of wood and four-bladed, about 9 feet in diameter, and runs at 800 revolutions per minute. When fully loaded, the total weight is 4.5 tons, and speed can reach 12 miles an hour. The motor is mounted forward under a hood which shields the pilot, while a light canvas roof is stretched over the middle of the boat, with cross benches for the passengers. Trials with the colonial glider on the Seine were so satisfactory that the inventor is now engaged in designing a larger craft on the same lines, which is to be 60 feet in length, and will carry a load of 15 tons. It is intended for use in the French colonies on the Mekong River.



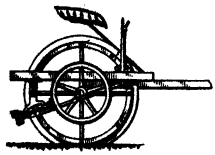
Emergency car closing the gate of a water main.



Automobile fitted up as a portable sawmill.

both for shifting the position of the machine and for raising and lowering the jointed platform.

CULTIVATOR.—A. RASMUSSEN, Edgemont, S. D. This invention relates to improvements in cultivators, and particularly to a corn cultivator, and has for an object the provision of an improved structure which is designed for



CORN CULTIVATOR.

use in what is known as dry farming, so as to maintain the soil in proper condition, and to reduce the foliage of the corn to a minimum, whereby the strength may go into the stalk and ear. Means provide for raising or lowering the cutter so as to adapt the same to corn of various ages.

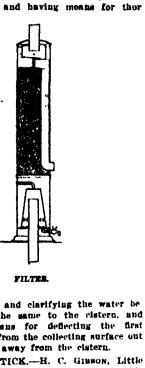
SHEAF HOIST AND CHUTE.—W. G PETROW and E. BEELY, R. F. D., Box 8, Mechanicsburg, Pa. This refers to an apparatus more particularly intended for elevating sheaves of unthshed grain to barns or other outbuildings, or onto stacks or mows. The invention contemplates also a chute so arranged as to distribute the sheaves over the mow or room

Of General Interest.

MATTRESS DISPLAY RACK.—A. FISHER, 1305 So. Lamar St., Dallas, Tex. In the present patent the invention has reference to mattress racks in which slidable trays are adapted to be projected beyond the front of the rack and supported in a tilted position for the proper display of the mattress.

PACK HARNESS.—H. H HAUGHT, care of W. H. Hilligass, Payson, Ariz. This invention has reference to a harness for securing packs on pack animals, and an object of the improvement is the provision of a pack harness which may be conveniently manipulated, and by means of which the packs will be properly held in place on the animal.

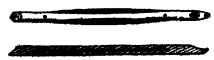
FILTER.—U. HOKE, Cornwall, Pa. Mr Hoke provides a filter especially adapted to be attached to the discharge pipe from the collecting surface, as, for instance, a roof, and to be arranged between the said collecting surface and the cistern and having means for thor



FILTER.

oughly purifying and clarifying the water before admitting the same to the cistern, and also having means for deflecting the first water discharge from the collecting surface out of the filter and away from the cistern.

MANICURE STICK.—H. C. GIBSON, Little Rock, Ark. The aim in this case is to provide a device wherein a support is provided for holding an abrading device, as, for instance, a file for abrading the finger nails in such man



MANICURE STICK.

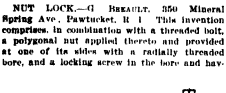
ner that while the abrading surface is held in a manner to be easily accessible, a guide is furnished for guiding the nail during the abrading operation and for limiting the extent of the nail which may be abraded.

Hardware and Tools.

MATCH HOLDER.—J. F. O'MALLEY, 126a W. 137th St., New York, N. Y. The improved match holder is more especially designed for holding a bunch of paper or wooden matches, and arranged to allow of conveniently fastening the bunch of matches in place and allow ready removal of a match whenever desired.

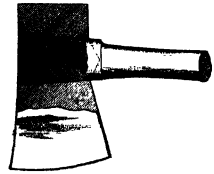
SPRING CLIP.—T. I. A. TOMASINI, Cayucos, Cal. This invention provides an auxiliary spring or spring clip to be attached to a leaf spring for keeping the leaves in place and to augment the resiliency of the leaf spring. It also provides an auxiliary spring simple in construction and inexpensive to manufacture

NUT LOCK.—G BERAULT, 350 Mineral Spring Ave., Pawtucket, R. I. This invention comprises, in combination with a threaded bolt, a polygonal nut applied thereto and provided at one of its sides with a radially threaded bore, and a locking screw in the bore and having its inner end provided with cross-wise grooves arranged at an angle to each other and forming four points that take into the adjacent grooves of the bolt and straddle the thread between the said grooves



NUT LOCK.

HANDLE FASTENING.—I. G BURTON, 1181 Broadway, New York, N. Y. The object of this invention is to provide a new and improved handle fastening more especially designed for fastening handles in hammers, axes, hatchets

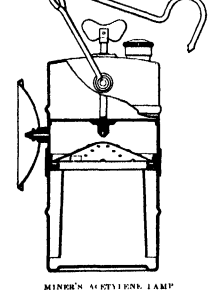


HANDLE FASTENING

and other tools and devices, and arranged to permanently fasten the handle in place in the socket of the tool and without unduly weakening the handle

Heating and Lighting.

MINER'S ACETYLENE LAMP.—Y. OBUCKA, 66 Mita Toyosakacho Shibu, Japan The object of this inventor is to obtain a lamp to maintain the action of lighting always perfect even should the lamp shell be deformed by severe shocking or dropping or careless treat



MINER'S ACETYLENE LAMP

ment in mines, and to hold the connection of two parts perfectly air tight by keeping the connecting part in a continuously wet state by the water dropping down from the water chamber to the gas generating chamber, whereby the escape of gas is prevented

ELECTRIC HEATER AND HUMIDIFIER.—W. C SMITH, Twin Falls, Idaho The invention refers more particularly to a combined heater and humidifier whereby vapor is generated by the heating elements of the heater and caused to mix with the heated air so as to temper the same and prevent the objectionable dryness of air heated by an ordinary electric heater.

SHADE HOLDER.—F. REUTTER, care of H. GOODFRIEND, Room 512, 6 East Lake St., Chicago, Ill. This invention relates to shade holders of that type disclosed in U. S. Letters Patent No. 1,039,519 formerly granted to Mr Goodfriend, and the general objects are to improve the construction of shade holders of the character referred to, so designed as to firmly grip lamp shades which may vary in size within certain limits.

LIQUID FUEL BURNER.—G. E. DENMAN, 355 Custer St., Fruitvale, Cal. This improvement pertains to burners through which liquid fuel is forced out into a fine evenly subdivided spray the particles of which are made to intermingle with the fluid used, and by means of which fluid the atomizing of the liquid fuel is obtained

Household Utilities.

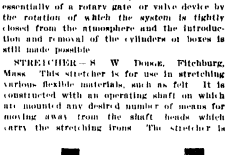
CHAIR, SOFA, AND SIMILAR FURNITURE.—E. A HOPSTATTER, care of Hofstatters Sons, Inc., 302 Second Ave., New York, N. Y. The intention here is to provide improvements in upholstered chairs, sofas and similar furniture, whereby an adjustable upholstering slat for the back frame is provided to enable the upholsterer to raise or lower the said slat according to the nature of the seat to be placed on the furniture

SANITARY DISH HOLDER.—D. F. CURTIS, Address the Vortex Mfg. Co., 412 Orleans St., Chicago, Ill. This holder is for holding dishes of paper adapted to contain ice cream, sundaes or the like so arranged that a sheet of paper cut to the proper shape may be inserted in the holder so that no part of the contents of the dish will contact with the material of the holder, and whereby the holder is so arranged that every part thereof may be easily cleansed after the used dish has been removed

Machines and Mechanical Devices.

APPARATUS FOR TUBULAR TRANSFERRING SYSTEMS.—L. LORENZBERG, 90 Rua da Alfandega, Rio de Janeiro Brazil. S. A. This apparatus is for use as a sender, receiver, or as a passage apparatus (intermediate station) for tubular transferring systems. It consists essentially of a rotary gate or valve device by the rotation of which the system is tightly closed from the atmosphere and the introduction and removal of the cylinders or boxes is still made possible

STRETCHER.—S. W. DOANE, Fitchburg, Mass. This stretcher is for use in stretching various flexible materials, such as felt. It is constructed with an operating shaft on which are mounted any desired number of means for moving away from the shaft heads which carry the stretching irons. The stretcher is

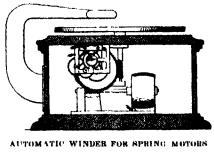


STRETCHER FOR FLEXIBLE MATERIALS

preferably supported in a stand for preventing its rotation with its shaft, the shaft being disposed horizontally for rotation in a crank and gearing. The stretcher is especially well adapted for stretching jackets for couch rolls used in paper making machinery

SHREDDING MACHINE.—S. T SPEARS, El Cajon, Cal. The principal object here is to provide a vegetable shredder comprising a suitable casing with a rotatable shredding element mounted therein this shredding element taking a plurality of forms whereby different degrees of shredding may be obtained

AUTOMATIC WINDER FOR SPRING MOTORS.—F. J. C. FREDERICKS, 379 Forest St., Jersey City, N. J. This invention has particular reference to means for automatically keeping the springs wound so as to relieve the operator from special attention and enable the machine to be actuated continually from the

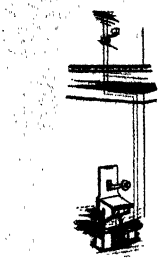


AUTOMATIC WINDER FOR SPRING MOTORS

spring motor. It provides a self winding device for a spring motor, such device to include an electric motor with a make and break device to start and stop the motor in accordance with the extent of the winding and unwinding movements of the spring or springs

EXIT DOOR CONTROL.—W. I. RESNIKOFF, 288 Pulaski Ave., Brooklyn, N. Y. To obviate objections, this inventor has devised a door structure which automatically unlocks when the same is approached from the interior side, in which the means for unlocking the door remain inoperative as long as the door remains open, and automatically become operative as soon as the door is closed

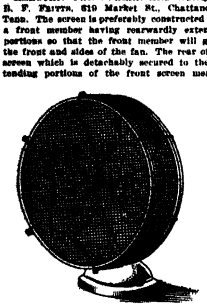
PAPER CUTTING AND FOLDING MACHINE.—F. P. HILDEBRANDT, 77 Partition St., Saugerties, N. Y. Among the principal objects of the invention is to provide a power driven automatic machine which will receive paper from a roll or rolls, slit the same into a plurality of strips, and then cut and fold the squares or sections of each strip to form, in



SAFEGUARD LIFE AND TELEPHONE ATTACHMENT.

property in case of fire, wherein means is provided for automatically sounding an alarm and at a time before the fire has gained too great a headway to be extinguished.

ELECTRIC FAN SCREEN AND GUARD.—B. F. FRITTS, 619 Market St., Chattanooga, Tenn. The screen is preferably constructed with a front member having rearwardly extending portions so that the front member will guard the front and sides of the fan. The rear of the screen which is detachably secured to the extending portions of the front screen member



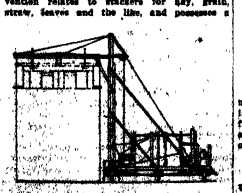
ELECTRIC FAN SCREEN AND GUARD

may be permanently secured to the fan motor casing, or, if desired, this rear screen member may be constructed in sections which are hinged together and which may be disposed around the fan for guarding the rear of the fan when the rear screen member is secured to the rearwardly extending portions of the front screen member.

CURRENT MOTOR.—J. W. LAURENT, S. 673 Monroe St., Spokane, Wash. This invention relates to a motor supported on a floating structure and adapted to be raised and lowered relatively to the stream, the motor, when lowered, presenting a broadside upstream. Means provide for raising and lowering of the motor for the proper bracing of the frame parts and the motor.

Of Interest to Farmers.

HAY AND GRAIN STACKER.—J. M. HARVEY and J. A. HARVEY, Ogden, Kan. The invention relates to stackers for hay, grain, straw, leaves and the like, and possesses a



HAY AND GRAIN STACKER.

number of desirable advantages, being especially adapted for receiving crushed or bales and other loads easily conveyed by one of a team, etc.

rapid succession, folded napkins of any suitable form.

MEANS FOR GOVERNING THE SPEED OF WIND MOTORS.—A. P. TURNBULL, "Romsey," Victoria St., Randwick, Sydney, New South Wales, Australia. In this invention the various improvements are effected by vertically hinging the tail piece to the pivoted head frame, and positioning the wind wheel at such a distance forward of the axis of the pivot that the wind pressure acting on the surface of the wind wheel imparts a predetermined effort to the same to rotate about such pivot and toward the hinged vane, which latter remains parallel in the direction of the wind, the effort mentioned being effected against an adjustable counteracting factor, such as a weight or spring

SPEED CHANGING DEVICE.—A. FRETZ, Edmond, Okla. An object here is to provide a speed governing device in which the speed may be controlled by the movement of the same lever. A further object is to provide a device in which any speed from a minimum speed to a maximum speed may be secured by the movement of the same lever

DRILL.—W. J. TURNBULL, deceased. Address H. W. Hills, Room 306, Wells, Fargo Bldg., New Orleans, La. The motor in this device is provided with means for anchoring the same from rotation in the well casing, the said means being electrically operated and releasable at will, and wherein a peculiar form of cutting blade or knife is provided, so ar



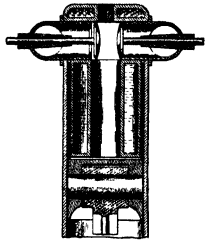
DRILL.

ranged that when in operation and actually cutting, the said blades will be extended beyond the peripheral surface of the well casing to undercut or undercream the same, which when not cutting and not in contact with the material to be cut may be moved into contracted position by the mere lifting of the drill

Prime Movers and Their Accessories.

CARBURETER.—D. MCRA LIVINGSTON, Manhattan, N. Y., N. Y. In the present patent the object of the invention is the provision of an improved form of carbureter, which will serve for the production of a proper fuel mixture under the conditions of operation of the engine.

INTERNAL COMBUSTION ENGINE.—J. M. BAILEY, Chiclana and 25 de Mayo, Bahia Blanca, Argentina. The invention provides improvements in internal combustion engines, whereby the piston, the cylinder, and the parts in the crank case may be readily oiled without danger of the lubricant passing into the combustion chamber and being burned therein.



INTERNAL COMBUSTION ENGINE.

Use is made of a water-jacketed cylinder head providing a combustion chamber in the said cylinder and spaced from the inner surface thereof to form with the cylinder an annular space and a piston reciprocating in the said cylinder and having a tubular extension passing into said annular space.

Railways and Their Accessories.

DOOR SILL EXTENSION FOR SUBWAY CARS.—C. M. SWEDBERG, 18 Willow Place, Yonkers, N. Y. More particularly, the invention relates to sill extensions at the doors of subway and elevated railroad cars so as to bridge the gap between the sides of the car and the edge of the station platform, in order to avert accident by passengers stepping into space between the platform and door sills on entering or leaving the cars.

DRIFTING VALVE.—C. JAMES, 90 Newall Ave., Rutherford, N. J. This invention provides means for supplying low-pressure steam to the cylinder of a locomotive while the same is drifting, the supply being diminished and determined as the progress of the locomotive diminishes and ceases, and provides means, operated mechanically in unison with the moving parts of the locomotive, for controlling the supply of steam to the cylinders.

CAR FENDER.—J. T. FULMERLE, 1107 Kirkwood St., Wilmington, Del. In this device the forwardly projecting frame of the fender will be tilted downwardly when an object falls upon the fender thereby preventing the frame and the car from riding over the object. Means provide whereby the air brakes are set when over the fender strikes an obstruction, such as an animal or a person, thus stopping the car automatically.

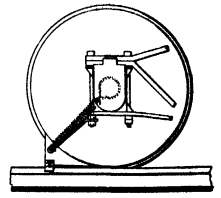
RAILWAY TIE.—C. SCHAFFER, Florence, Arizona. The objects in this case are to provide a metallic railway tie, together with a novel arrangement of supporting blocks therefor, as well as tie straps to be employed in connection with the ties and blocks at the joints, the pur-



RAILWAY TIE.

pose being to form a substantial support for the rail; to provide for assembling the parts so that a proper alinement will result; and to afford an effective bracing means for the rails and for resisting the contraction and expansion of the rails.

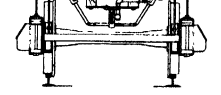
TRACK CLAMP.—T. N. ROBINSON, Box 134, Waterford, N. Y. This invention relates to track clamps or grips used in connection with railway ties and truck wheels. The device is for use in connection with a truck wheel whereby the clamp will automatically act between the wheel and the rail to prevent movement of the wheel or truck in the direction of



TRACK CLAMP.

the clamp. An advantage of this device is with respect to its reliability of operation and facility with which the biting element thereof may be renewed or replaced or with which the entire clamp may be detached or swung out of the way when not to be used for a clamping purpose.

SAFETY APPLIANCE FOR RAILWAY CAR TRUCKS.—F. G. WILLERS, 120 Hersey St., Cadillac, Mich. Mr. Willers's invention is embodied in mechanism applied to a car-truck, whereby the air brakes are applied in case a car wheel leaves the rail or a brake beam drops,



SAFETY APPLIANCE FOR RAILWAY CAR TRUCKS.

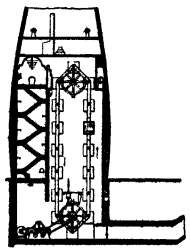
or axle bearings become displaced. His invention is embodied in a mechanism which operatively connects certain parts of the truck with the valve lever, so that the latter is raised and the valve opened when some of such parts become displaced.

CAR FENDER.—A. T. GOODIN, 50 Dana St., Cambridge, Mass. An object of this inventor is to provide a street car fender adapted to be swung to a raised position and held in compact form when not required for use, but which will possess such rigidity, when lowered, as to resist any tendency to roll up or rise when striking a person

SMOKE FILTER AND SPARK ELIMINATOR.—E. H. GAGNON, 116 House Bldg., Pittsburgh, Pa. This improvement is in devices for filtering smoke and eliminating sparks from locomotives and the like, and has for an object to provide a structure which will filter and clean smoke from a locomotive previous to its discharge without affecting the usual draft provided.

Pertaining to Recreation.

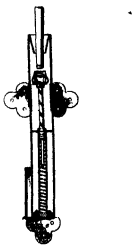
AMUSEMENT DEVICE.—E. C. MANTZOLL, Casella No. 27, Rancagua, Chile, S. A. This device produces the imaginary effect of an aerial trip to a distant planet on a projectile supposed to be projected from the structure, which is in the form of a cannon having its muzzle pointed upwardly, while it is nothing more than a car mounted within the structure



AMUSEMENT DEVICE.

and has a movement accompanied with an explosion, so that the participants will imagine their projection through space, and at the end of the flight they leave the car and enter a hall or cavern of fantastic scenes of an imagined planetary destination, and thence an exit to the street.

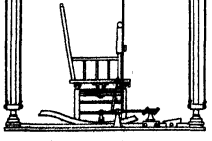
DEVICE FOR CHALKING CUES.—H. H. LEECH, 72 East Third North, Portland, Ore. One of the principal objects here is to provide a device which may be attached to a suitable portion of a billiard table, and which may be



DEVICE FOR CHALKING CUES.

used to automatically chalk the billiard cue tips. The invention embodies means whereby the chalk dust may be caught and delivered to a suitable receptacle.

EXERCISER.—E. A. FRIEDEL, 605 Prospect Ave., Canton, Ohio. The apparatus provides a wide range of exercises and are readily adapted to adults of both sexes and children. The necessary adjustments are provided to accommodate the apparatus to the size of the user. It



GYMNASIUM EXERCISER.

makes possible not only effective pedal and arm exercises, but complete bodily movements, since the occupant of the chair in gripping the hand holds or the trapeze, and utilizing the pedals or foot rest, may perform various body movements.

BAIT HOLDER.—C. W. LANE, Madrid, N. Y. This invention consists in the improved holder proper for live bait, especially minnows, and in an attachment of the same comprising barbed hooks, which are released from the holder proper when a fish takes the bait in the act of biting it.

GAME APPARATUS.—J. H. MCCLELLAND, care of A. Stearns, 320 E. 42nd St., New York, N. Y. This invention relates to games and sport and has particular reference to games of an educational as well as to amusing nature, and is adapted especially for use by young children. The game provides for teaching the economic victory of good over evil as the optimistic domination of right combined over evil conduct or influences.

Pertaining to Vehicles.

CHECK HOLDER FOR AUTOMOBILE DRIVERS.—D. JOSEPH, 106 W. 126th St., New York, N. Y. The check holder is mounted on the automobile at a suitable position, as, for instance, the dashboard, so that the attendant at the hotel, theater, or department store can deposit the driver's check into the holder,

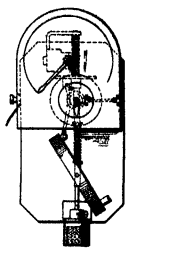


CHECK HOLDER FOR AUTOMOBILE DRIVERS.

where it is always in view, and as it is not given into the possession of the driver, there is no danger of its being lost. When the driver is signaled to return and take away the patron having the corresponding check, the holder may then be opened by either the attendant or the driver. The check drops out and is then annulled.

SANDING DEVICE FOR AUTOMOBILES.—C. L. LINCOLN, care of Dept. Parks, 2823 Clarendon Road, Brooklyn, N. Y. This invention provides a device to discharge fine gravel, dry, coarse sand or a similar dry, non-packing material, onto a roadway immediately in front of the bottom portion of the tires of the rear or drive wheels to prevent the vehicle from skidding on a slippery roadway.

SPEED MEASURING AND CONTROLLING DEVICE.—J. H. COBB, 900 3rd Ave., Nashville, Tenn. This invention provides means for accurately indicating the speed of a vehicle and for enabling the user of the vehicle to set the



SPEED MEASURING AND CONTROLLING DEVICE.

device so that it will automatically control the speed. The device is primarily designed to be used with the ignition circuits of automobiles having internal combustion engines or with the motor circuit of electric automobiles

Designs.

DESIGN FOR AN ELECTRIC BRACKET LAMP.—C. KAUFMAN, Santa Ana, Cal. In this ornamental design the bracket and lamp comprise lines of original and graceful form, the electric bulb being seated in an attractive bowl-shaped shade.

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PATENTS FOR SALE

FOR SALE. Patent on "Case Cartridge," useful as sheet music holder or drawing case. Must be colored like a rifle cartridge, ferrule inch, handles white color. John Jorg, Camp 4, El Portal, Cal.

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Inquiry No. 9389. Wanted the name and address of manufacturers of valves, cylinders, recording gages, filling and weighing stands and all material and appliances which enter into the manufacture, transportation and sale of compressed gases.

Inquiry No 9390. A syndicate of gentlemen desire to get in touch with an inventor or manufacturer of some small patented article with a view of placing the same on the market. Large capital and expert sales force if the invention or article stands examination. Automobile specialties preferred.

Inquiry No 9391. Wanted the name and address of makers of plants for the utilization of by-products from sawdust, also waste wood.

Inquiry No 9392. Wanted the name and address of the owner of some good patented article open for sale on commission or specified territory. The article to retail from $5.00 to $10.00.

Inquiry No 9393. Wanted the name and address of someone who has an article which could be made in a large Hickory Handle plant.

Inquiry No. 9394. Wanted the names and addresses of firms that deal in machinery for manufacture of plaster of Paris and drying by hot air.

Inquiry No 9395. Wanted names and addresses of manufacturers capable of manufacturing cloth Boards (made of paper, wood, and metal) also sample books. One who is able to turn out unlimited quantities at right prices.

Inquiry No. 9396 Wanted the names and addresses of makers of furnaces for reducing carbonate of barium to oxide, electric or otherwise.

Inquiry No. 9397. Wanted the name and address of a manufacturer of a machine that will automatically dose and fold powders and other preparations.

Inquiry No 9398 Wanted the name and address of a manufacturer of a machine to print and label lead pencils and pen-holders.

Inquiry No. 9399 Wanted the name and address of workers in ornamental polished stone.

Inquiry No 9400. Wanted to buy an insoluble, non-fusible and opaque plastic material to be used in die moulds for manufacturing tobacco pipes of special kind.

Inquiry No. 9401. Wanted the name and address of the owner of a second hand aeroplane motor from 20 to 30 H.P.

Inquiry No. 9402. Wanted the name and address of a manufacturer who can make a tin toy.

Inquiry No. 9403. Wanted the name and address of a glass manufacturer who can blow a small glass article to order.

Inquiry No. 9404. Wanted the name and address of a manufacturer of a tool for cutting slots in plate glass used for name plates and house numbers.

Inquiry No. 9405 Wanted the name and address of a manufacturer who is able to supply an attachable [illegible], aluminum or celluloid through which a [illegible] would work.

Inquiry No. 9406. Wanted the name and address of a manufacturer who can supply [illegible] material in rolls. The material seems to be scrap leather compound and [illegible] to a canvas [illegible].

Inquiry No. 9407. Wanted the name and address of [illegible]

Inquiry No. [illegible] Wanted the name and address [illegible]

The Electrical Measurement of Star Light

(Concluded from page 408.)

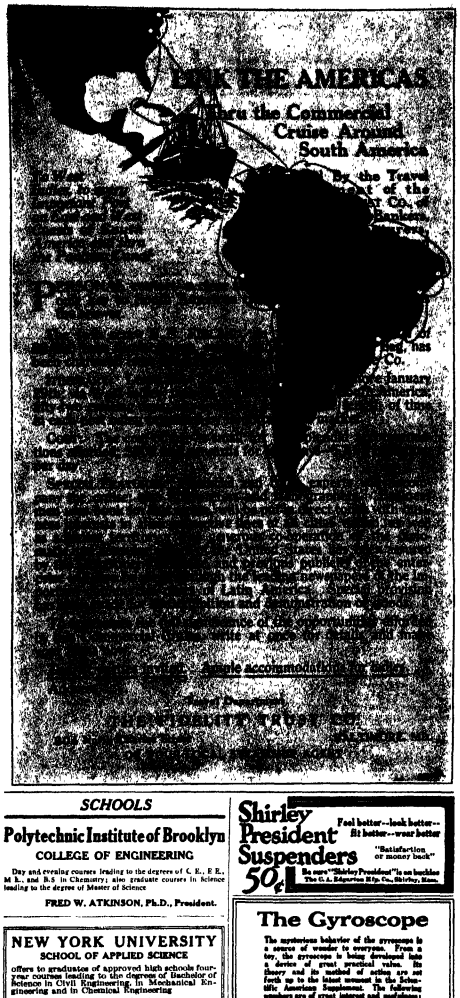
bodies complete the circuit around the common center of gravity in only a few days, in some cases less than one day, and in one system the period is only five hours!

The North star, or Polaris, as it is called, has a companion which goes around in about four days, and one of the first questions asked when the spectroscope revealed this second body was: Does Polaris vary in light due to the presence of this companion? This problem has been attacked by practically all methods, visual, photographic, and electrical, and all agree that the North Star is continually fluctuating about its mean brightness in a period of four days. The extreme range is about 10 per cent, and while this change is undoubtedly due to the companion, the exact influence of the second body is not understood. This light-variation of Polaris is quite similar to that of numerous other objects in the sky, many of which vary 50 per cent or more, and the determination of the cause of variability in one star will probably lead to an understanding of them all.

There is another kind of star, however, where the influence of a companion upon its light is well understood. Suppose the second body happens to go around in a plane which passes very near or through the position of the earth. Then every time the companion passes in front of the main body there will be an eclipse, and the star will appear fainter to us. Measures of such stars are especially within the province of the selenium photometer, and in Fig. 3 is shown a system which has been observed with this instrument. The star is Beta Aurigae, that is, the second brightest star in the constellation Auriga, an object in the winter sky about as bright as Polaris. The spectroscope shows that here we have not one body but two practically equal in size and brightness, which go around in a common circular orbit in just less than four days, or 95 hours. The plane of the orbit is slightly tipped, but during six hours there is an eclipse, which is repeated 47½ hours later when the positions of the bodies are interchanged. The dotted circles show the bodies at the maximum eclipse, when 7 per cent of the combined light is lost, and therefore when 7 per cent of the total apparent area of the two disks is occulted from one of them by the other. From the duration of the eclipse as compared with the total period of revolution it may be calculated that the distance between the two spheres is 6.8 times the radius of each. Now from the spectroscopic results the size of the orbit in miles is known, and with other data as to the distance of the system from us we are able to compute the results for comparison with our sun. In the figure, which is all drawn to scale, the smaller shaded circle represents the sun, and it shows that each component of Beta Aurigae is a giant even when compared with our own mighty orb. Each body has 2.6 times the diameter and 2.4 times the mass of the sun, but is only one seventh as dense. It is in light power, however, that the results are the most striking, as each body emits one hundred and fifty times the sun's light, or a total of three hundred times for the two! Let the reader imagine, if he will, the dazzling appearance of such a system, each star intensely white, and beside which our yellow sun would be almost dark.

The foregoing case has been selected as showing what can be inferred about a stellar system when the necessary data are obtained. In other cases the two bodies may be unequal as to size and brilliancy, but in Beta Aurigae the conditions are most favorable and the data most complete, and it is no exaggeration to state that we know more about this star than any other in the sky; also the size and weight of each component have been measured by an electrical method.

Even in astronomy the modern technical advances are being used, and the astronomer can derive electrical power from a heavenly body, although he has not as yet literally hitched his chariot to a star.



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Scientific American Supplement 1645—The Theory of the Gyroscope, is an excellent article, treating the subject mathematically rather than popularly.

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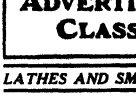
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Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No stipulation will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(13028) W. J. C. asks: Kindly answer the following question: A weight suspended from a wire (say a cubic foot of iron) how much less does it weigh when immersed in water (say sea water), and how is the difference in weight computed? Also, will it weigh any less when immersed to greater depths? A. A cubic foot of iron when immersed in water will displace a cubic foot of water, and will weigh as much less as the water weighs which it displaces. This is in accordance with the Principle of Archimedes, which is: "A body immersed in a fluid is buoyed up by a force equal to the weight of the fluid displaced by it." Fresh water weighs 62.4 pounds per cubic foot at 39 deg. Fahr., and sea water weighs about 64 pounds per cubic foot, so that a cubic foot of iron, or anything else, would lose the weights given above upon immersion in fresh or salt water.

(13029) H. S. S. asks: I would like to have your answer to the following question. Was gunpowder discovered or invented? This question came up in high school, some say it was invented, some say discovered. To determine whether gunpowder was discovered or invented you should first learn from the dictionary what a discovery is and what an invention is. You will find that a discovery is the act of finding out or bringing to knowledge what was unknown, but which was in existence, for example, the *discovery* of America. America was where it is now, but was not within the knowledge of the world. Columbus discovered it. Invention is the act of finding out how to make something previously unknown, or to do something in a new and different way, as for example, the *invention* of printing. The idea in invention is novelty, the thing or process then and did not previously exist, so far as the inventor knew. The Century Dictionary has this statement: "The invention of gunpowder in Europe has been ascribed to Roger Bacon and to a German monk named Schwartz." The Encyclopedia Britannica, under "Gunpowder," has this statement. "It is probably quite incorrect to speak of the *discovery* of gunpowder. There is not sufficient solid evidence to pin down its invention to one man." Bertold Schwartz was generally considered to be the inventor of gunpowder. This should enable you to settle the question.

(13030) E. J. F. asks: Will you kindly advise me if water boils quicker at an elevation, as well as at a lower temperature? A. Water can be boiled in less time at a high elevation because it boils at a lower temperature. Its temperature does not have to be raised through so many degrees as at a lower altitude.

(13031) R. R. asks: Will you be so kind as to give me information where I can get an instrument to locate silver or gold? I have reliable information that money has been hidden in the ground and I want an instrument or dipneedle to locate the same. We do not know any instrument which can locate buried gold or silver. We are receiving so many requests for such an instrument that we print this inquiry and reply so that all may see it and be saved the labor and trouble of writing us on the subject. A dip needle is a magnet, and no magnet has the slightest attraction for either gold or silver.

(13032) A. K. D. asks: Could I, as a reader of your valued columns, get a little information on painting or blackening brass? A. In most of the processes for blackening brass the article is dipped in the solution and heated to set the color. A black to be applied with a brush may be made by adding flake lamp black to brass lacquer or fine shellac varnish. When dry it may be polished by rubbing gently with paraffine on a soft cloth. This will probably not last any longer than the paint which the company have furnished you. All such coatings crack off from metal which is handled very much. Our "Cyclopedia of Receipts" gives eleven processes for blackening brass. We send it for $5.

NEW BOOKS, ETC.

THE THEATER OF MAX REINHARDT. By Huntly Carter. New York: Mitchell Kennerley. 1914.

The contemporary stage is a kind of picture box within which characters must move and talk. Although the actors are alive and strut about with a certain degree of spontaneity, a theatrical production, such as most of us know it, is in reality a magnified puppet show. Even though much ingenuity is expended on well constructed properties and well painted scenery, it is difficult to create the artistic illusion of reality. As the demanded of the spectators as of the actors: for the spectators are asked to believe that this three-walled picture box into which they are gazing is in reality a four-walled room, that the hero comes and goes as he does in a perfectly natural manner and not because he is constrained to come and go in a conventional way by entrances and exits limited in number and position.

No matter how we change the theater, there will always be some such limitations upon the dramatist and the theatrical artist; but that is no reason why we should adhere to the human puppet show, which our theatrical fates and traditions and which to date for every other civilized people now, whether it be a savage theater of the world may be.

Max Reinhardt has made a distinguished and artistic attempt to release the theater from the old thraldom. In his theater this spectator is not merely an onlooker, but almost an participator; for he is made to feel that he is part of the drama that is being enacted before his eyes. In order to project the spectator into the action, Reinhardt converts the stage into an arena, in a word, gives it that fourth wall which it has hitherto lacked. Hence audiorium and stage are practically one. Since the spectator is no longer contemplating an animated picture, since the scenes are thrown almost in the very midst of the audience, painted canvas is all but abolished. Instead we have solid cubes, walls and nooks—real three-dimensional structures which must be designed by an architect rather than by a scene painter. This change in the character of the setting has brought about with it a change in lighting. The play of light upon neutral tinted surfaces focuses and accentuates the emotions more effectively than colored pigment.

Since the picture box stage has given place to the arena stage in the Reinhardt system, the act interval cannot be the same. To reduce the act interval has been a great problem. Reinhardt has met it by using the revolving and the sinking stage, as well as by employing the Greek device of intervals filled in by a chorus.

All this seems very mechanical, a contribution to stage architecture rather than to dramatic art. Yet Reinhardt has in reality given the drama a free rein, and encouraged a type of play which, in a sense, never had full scope upon the old stage. In a picture box real action is so limited that the audience must forget or overcome ridiculous conventions; in the Reinhardt arena a vast horde can rhythmically flow in and out, sway back and forth in a torrent of life. Hence the Reinhardt theaters in common a revival of that type of Greek drama which reveals elemental human passions. We shall have action where hitherto we have had mere talk.

Of the conception and development of this new type of theater and drama, Mr. Carter has given us a very interesting and vivid picture. His book must prove an intellectual stimulus to every thinking lover of the theater.

MOTORCYCLES, SIDECARS AND CYCLECARS. Their Construction, Management and Repair. By Victor W. Page, M.E. New York: Munn & Co., Inc. 550 pp.; 350 illustrations. Price, $1.50.

Those who have read Mr. Page's book on the automobile will welcome this volume on the motorcycle, in which he treats his subject with his usual thoroughness and clearness. Previously to this there has been nothing of a competent nature published in this country on the motorcycle, but in Mr. Page's book every detail of motorcycle construction is carefully explained, including power plants of both two and four cycle design, and various systems of carburetion, ignition and lubrication. Clutches, speed change gears, starting devices and brakes are fully covered and illustrated by many engravings of the best American and foreign machines; while for those who require technical information many useful tables and formulæ are given. Sidecars are fully covered, and a chapter is devoted to the cyclecar that is instructive. While the matter covered is mainly descriptive and explanatory, some space has been devoted to the practical questions of operation and maintenance. As a whole, it is a useful book of reference, and by far the best of its kind yet published.

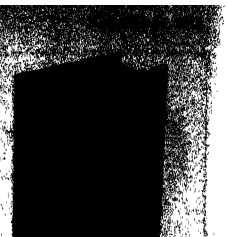
THE BEGINNER'S GARDEN BOOK. A Text-Book for the Upper Grammar Grades. By Allen French. New York: The Macmillan Company, 1914. 16mo.; 402 pp. Price, $1.

Now that the garden enters so largely into the school life in many institutions of learning, it is not unreasonable that a special text book is required. The volume before us is well illustrated and well printed, and will tend to give the students an excellent idea of the fundamentals which underlie gardening, and will result in an awakened love of flowers and an understanding of the economic value of vegetables. The book will be of special value when the children are brought into direct contact with nature, and they must necessarily profit mentally and physically. In many places children are kept busy who otherwise might be idle through the weeks of vacation. They learn to work and they understand the values created by work, and they gain from this both self-respect and respect for property. Gardening thus becomes a lesson in civics. In addition, in country towns it becomes a specialty, as emphasized in the future, must be stimulated by gardening. The garden movement is, for all these reasons, of even national importance. The volume before us covers not merely the school work indoors and out, but also the work of gardening at home.

TELEPHONE CONSTRUCTION, INSTALLATION, WIRING, OPERATION AND MAINTENANCE. By W. H. Radcliffe and H. C. Cushing, Jr. New York: The Norman W. Henley Publishing Company, 1914. 24mo.; 223 pp. Price, $1.

This book describes and illustrates up-to-date methods of telephone practice, including the principles of, construction and operation of telephone instruments, approved methods of installing and wiring them; the means of protecting them from lightning and abnormal currents; their connection together for operation as suites or building systems. It is intended for electricians, linemen, engineers, contractors and all others interested in standard telephone practice.

HAIRS AND FEATHERS FROM PAUL AND PERSIA. By Florence B. Scott. New York: Hurst & Co., 1914. 16mo.; 320 pp.



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Development and Status of the Wood Preserving Industry; Notes on the Art as Practised in America. By E. A. Sterling. Scientific American Supplement No. 1998.

The Preservation of Wood. A Synopsis of the Principal Processes in Use Today. By A. L. Webb Taylor. Scientific American Supplement Nos. 2012, 2013 and 2014.

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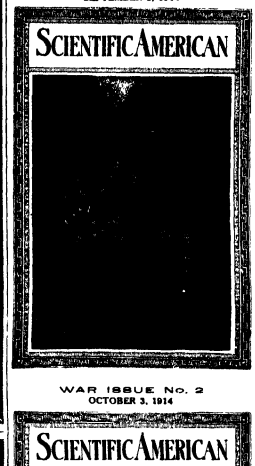
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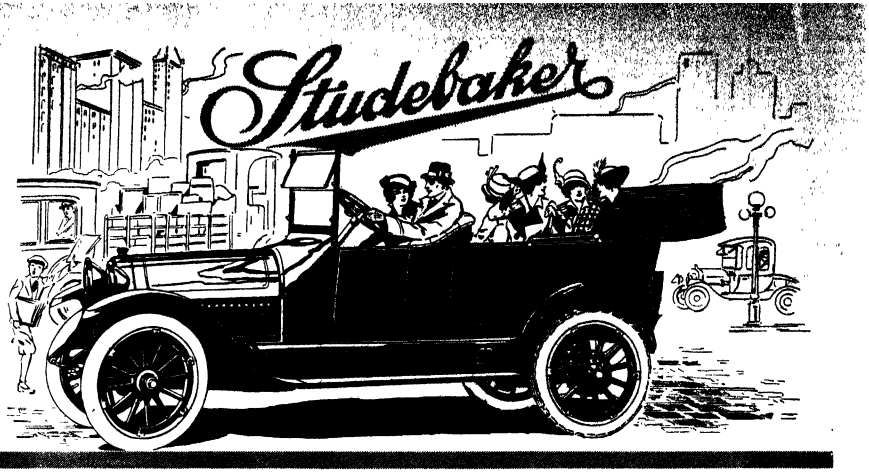
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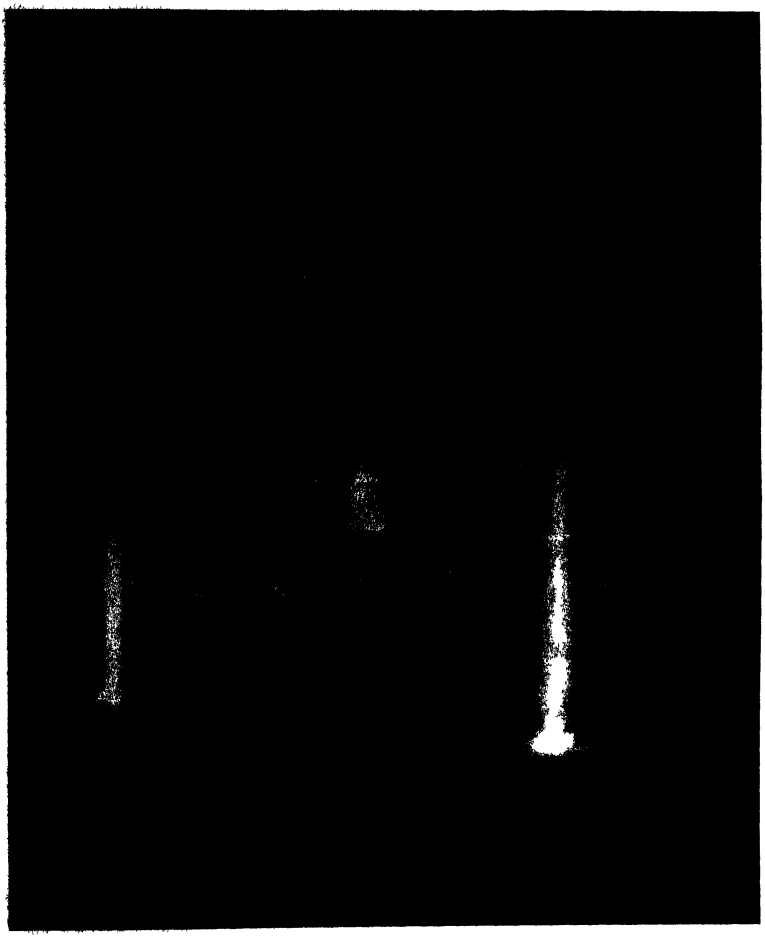
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SCIENTIFIC AMERICAN

16. NOV. 1914



BURNING AND BLOWING UP OF THE "GOOD HOPE IN THE ENGAGEMENT OFF THE CHILEAN COAST BETWEEN THE GERMAN AND BRITISH SQUADRONS —[See page 420]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Entrenched Troops Versus 16-inch Mortars

THE 16-inch mortar, conceived and brought into existence behind a veil of strict secrecy at the Krupp works, was Germany's answer to the frontier forts of the French line of defense. We all know what happened when this latest exemplification of the irresistible force and the immovable obstruction met. The German giant with its smaller brethren, the Austrian 12-inch and the German mobile 11-inch pieces, cut their way through the Belgian and French fortifications with something of the ease with which a keen knife divides a pat of butter. Had the momentum of the German rush through northern France been sufficient to carry the masses of German infantry up to the ring of permanent fortifications encircling Paris, these same mammoth siege pieces would have been emplaced to the rear, and, with sure and swift deliberation, they would have cut an open road for the German army right into the very heart of Paris itself.

We have pointed out more than once in these columns that, in the history of warfare, every novel means of attack has found an adequate means of defense developed to meet it; but when the story of Liége, Namur, and Maubeuge was made known, it seemed as though Germany had for once secured the whip hand, by producing an engine of attack to which no adequate reply could be made.

Nevertheless, even in the case of this stupendous weapon, it begins to look as though history would repeat itself in the matter of defense; for an effective answer to the 16-inch siege gun has been found in the infantryman with his rifle and entrenching tools. And herein is to be found an explanation of the fact that such great barrier fortifications as those at Verdun are to-day standing intact against the German invasion. For had the Germans been able to carry their lines of entrenched infantry, with their supporting field artillery and machine guns, sufficiently close to these fortresses to make possible the emplacing of their heavy siege artillery well to the rear but within striking range, these fortresses would have crumpled up under the attack many weeks ago. The desperate fighting, the endless attack and counter-attack, which have been taking place between the German and French hosts around Verdun, has been a struggle for the possession of that perimeter of the surrounding terrain, within which the German siege artillery must be emplaced if Verdun is to be taken.

And so there has come about a most curious inversion of the intended relation of permanent fortifications and troops. Instead of the fortress protecting the troops, the troops are protecting the fortress—which may be taken as another evidence of the fact, recently alluded to in these columns, that the day of permanent fortifications is practically over.

Failing an opportunity, for the present at least, to use these guns for their intended purpose, the Germans are emplacing them in the rear of their entrenched infantry and are using them for the attack of field entrenchments—another curious development of the war. Used under these conditions, their effect is more moral than material. A costly 16-inch shell, one successful hit with which will turn a powerful Gibraltar into a rubbish heap, is a good investment; but a 16-inch shell dropping on soft ground and producing a solitary, if very formidable-looking crater, here and there along a stretch of three hundred miles of field entrenchments, is not to be regarded as making a very good return upon the money invested. For the shelling of entrenchments, occupied villages, or open cities, the greater volume of fire delivered by the lighter German howitzers is far more effective than the occasional dropping of one of these monster projectiles. The great range of the mortars is, of course, a valuable asset; but an equal range could be obtained by the smaller and more rapidly firing howitzers, by increasing the caliber-length, the powder pressure, and the muzzle velocity. In the case of the smaller pieces, there would be the great practical advantages of swift mobility, rapid emplacement, and, as we have said, a vastly greater volume and rapidity of fire.

If the French and English should succeed, like the Russians, in rolling the tide of invasion back over the German frontiers, the Allies will be confronted with *the same difficulties*, in bringing their heavy siege artillery to bear upon the German fortifications. There will have to be, in every case, a bitterly contended fight for the emplacement sites, before the reduction of the fortresses can be undertaken.

All of which goes to prove, once more, that the man is ever greater than the machine.

A Few Thoughts on Man

THE Scottish Shorter Catechism asks the question, What is the chief end of man? It goes on to ask a number of other questions, all more or less interesting, and in most cases the questions are much more illuminating than the answers. But this question seems the most significant of them all. The answers to it appear somehow even less conclusive than the answers to other questions. Of course, by continually asking why, any philosopher can be nonplussed about anything, as most people who have had much to do with children are perfectly aware. A few childish questions can reduce all learning to futility.

Science has practically given up answering whys and contents itself with describing hows. If you ask a scientific man why a stone falls to the ground, he will tell you that he doesn't know. Not long ago he would have replied that it fell to the ground because the earth and stone attract one another. This is very much the same as saying that an unsupported stone falls to the ground because, as has been ascertained by frequent experiments, an unsupported stone falls to the ground. But if you ask a scientific man *how* a stone falls to the ground, his intelligent countenance will light up at once and he will talk for a long time. He will talk about the acceleration of the stone, mention Newton, and say something which sounds complicated about inverse square of the distance and directly as the masses. In short, Newton's law of gravitation tells how bodies approach one another, but does not profess to say why they approach one another. There are some ingenious gentlemen, many of whom live in France, who think that is all Science can do, and perhaps they are right.

It is rather important that the modern scientific attitude about these things should be understood. Misunderstandings have arisen because it has not been understood. For instance, Mr. G. K. Chesterton, usually an entertaining and valuable writer, has written, through ignorance, quite a lot of nonsense about science. Among other things, he says that scientific men "imagine a necessary mental connection between an apple leaving the tree and an apple reaching the ground." Scientific men do nothing of the kind. Mr. Chesterton is speaking of the superior logic of fairy tales, and the real scientific man is quite willing to meet him on this ground. A scientific man has no objection to saying that the apple is inhabited by a fairy whose somewhat monotonous idea of amusement, or whose inflexible sense of duty, causes it to make the apple reach the ground whenever the apple is unsupported. Of course, the scientific man would require evidence for this, and he would point out that the path followed by the apple and the acceleration imparted to it by the fairy, were in accordance with Newton's law of gravitation. He asserts that Newton found a formula describing how the apple reaches the ground, but not why it reaches the ground.

But to return to the Scottish Shorter Catechism, the question, What is the chief end of man? is in itself a little ambiguous. We may take the word man to mean *man individually or to mean the human race*. Taking the question to have the former significance, it seems to be thought by some writers that man's chief end is to make himself a means. The next generation is to be made better by our efforts, and that is to make the next generation better and so on, until finally perfection is reached, or the race comes to an end. When perfection is reached, the race presumably occupies its time in maintaining itself perfect. It may have occurred to some writer of this school to show that perfection can never be reached, but can be more and more closely approached, like the limit which represents the sum of an infinite series. This does away with the bother of describing how the generations which reach perfection dill in their time.

This answer does not satisfy, but there is nothing more satisfactory to put in its place. It is hard to believe that all the activities of life somewhere are to be judged according to their effect on the next. And the answer is not a practical one because it ignores philosophy. We might agree to help make the next generation better, but our notion of what is better might be very different from those of other people. It might be, as one will easily agree after a little study of some pessimistic philosophers, that there are people who think the best thing to do for the next generation is to prevent its coming into existence. Even if we agree to let the next generation exist, we might disagree about how it is to exist. It depends on our theories. One might insist on healthy children. If we believed some writers, we should insist on unhealthy children, because they have keener spiritual perceptions, and spiritual perceptions are more desirable than anything else. If Nordau is right, and geniuses are insane, then perhaps we should encourage insanity. The answer given in the Catechism itself to the question conveys nothing whatever. None of the chief terms are intelligible. But the other answers convey hardly more, so perhaps the orthodox answer is as good as the others. It may be better. It may be incomprehensible because it is true.

Accessibility in Motors

A FEW years ago there seemed to be a perfect rage in this country for motorcars in which every part of the motor was "accessible"; that is to say, at the mercy of every driver or new owner who wished to emulate the little boy and his desire to see "what makes the wheels go round." To-day the shrewd automobile manufacturer incloses every vital part of the car in such a shell of steel, that it is prone to discourage the would-be tinkerer. The modern passenger-carrying automobile should be left severely alone by the untrained man; it takes an expert mechanic to take it apart and put it together again!

On the other hand, the commercial motorcar should be as accessible as possible, and of such standardized and interchangeable parts as to make quick repairs easy of attainment. The European war, in the first few months, has taught the British and French a few lessons about standardization and accessibility which they are not liable to forget. Single trucks and whole convoys have been lost because of the inability of the driver to make replacements and exchanges of magneto parts and other important units of the machines. Drivers of subsidized trucks in the war are supposed to be mechanics, and capable of making ordinary repairs on the road; the private owner of a touring car usually is not qualified to do such work. If, therefore, the war experience proves the value of accessibility in the motor of a truck, it does not change the opinion of the automobile trade as to the necessity of protecting the motor of a pleasure car from tinkering by untrained hands.

Interplanetary Masses of Gas

IT is suggested that some of the striking changes manifested by certain comets in executing their orbits are due to the fact that they encounter masses of gas in interplanetary space, and that they are not moving in a vacuum. If there are such gaseous masses, then in view of the inclinations and extent of their orbits, comets are peculiarly fitted to act as explorers, and there is every probability that they would sooner or later encounter such masses.

The planets move in a narrow zone near the plane of the ecliptic, while the inclination of the cometary orbits is sometimes considerable, varying for the periodic comets from 3 degrees to 162 degrees. As a consequence comets attain regions of the solar system where no other bodies penetrate. Many phenomena seem to receive a satisfactory explanation if the existence of gaseous masses scattered through the solar system be admitted. These gaseous masses, probably of different chemical constitution, may be considered as the residue of the initial nebula, having escaped the phenomena of combustion which gave rise to the other members of the solar system.

Rinderpest in the Philippines.—Rinderpest, which has decimated the carabao in the Philippines for many years in spite of energetic quarantine measures, will probably be stamped out entirely before long, if the new plan under consideration of immunizing the cattle against this disease should prove successful. An official test recently made on 8,000 animals proves that permanent immunity can be attained by a simple process, at a cost of not more than 50 cents a head, and with a loss of less than 1 per cent of the animals treated. It is estimated that all the cattle in the infected provinces could be immunized in two or three years at a total cost of not more than $100,000, which is about half what the government now spends each year for quarantine, while $75,000 would insure owners against loss by the immunizing process. A further expense of $60,000 a year would provide for the inoculation of all young stock and imported cattle.

Engineering

Floating Crane at Panama.—The new floating crane Ajax of 370 tons capacity, which was recently imported from Germany, is now ready for its test at Panama. Before long the sister crane Hercules will be afloat. These two are said to be the largest floating cranes in the world.

An Opportune Fund.—A fund of $50,000 for "promoting commerce in Central and South America" which has just become available to the Department of Commerce should be of material assistance in teaching the expected infant, our merchant marine, to walk as soon as the shipping bill and government insurance are in working order.

To Fly the American Flag.—Since the passage of the act of August 18th, eighty-one foreign-built vessels of 285,208 gross tons have been admitted to American registry. Of these, nineteen are passenger steamships, and sixty-one are freight vessels. According to Commissioner Chamberlain, additional ships are being added to the American registry every week. Sixty-eight of the above vessels were formerly under the British flag, eight were German and five were Belgian vessels.

Proposed Baltic and Black Sea Canal.—The commission appointed by the Russian Duma and Senate four years ago has reported favorably on the proposed Baltic and Black Sea canal scheme. It is proposed to canalise the Dnieper and the Dwina, the former flowing into the Black Sea at Kherson, and the latter into the Gulf of Livonia and the Baltic Sea at Riga. The sources of the two rivers at the divide would be connected by artificial waterways. The length of the canal would be 1,540 miles.

Belt Railway for Peking.—The Chinese Ministry of Communications has completed an arrangement with the city authorities of Peking to establish a line seven miles long, which will hug the wall its whole length, and connect the terminals of the Peking-Kalgan, Peking-Mukden, Peking-Tung-chow and the Peking-Hankow railways. Two tunnels will be bored on either side of the existing arch forming the Chien-men; one will be used for the proposed tramways and the other for passenger traffic.

Fuel Oil Experiments on the Railways of Chili.—The Chilian Government which has had under consideration for some time the installation of oil-burning equipment on all the government-owned railways of the country, has decided to turn over one entire division of the Longitudinal Railway, about 125 miles long, for exhaustive experiments. The proposition was worked up and will be carried out by engineers from the United States. The consumption of fuel oil in Chili has increased since 1904 from 5,600 tons to over 230,000 tons last year.

Panama Canal and Transcontinental Freight.—The influence of the Panama Canal upon the movement of freight by rail has been greater than was anticipated and the amount of tonnage which is being sent through the canal is a matter of surprise to those who are accustomed to the handling of transcontinental freight. Since August 15th, when the canal was opened for business, over fifty ships varying in size from 6,000 to 12,000 tons have been carrying through the canal freight consigned to the Pacific Coast. A considerable proportion of this is being moved, even from as far West as Ohio, by the way of New York and the canal to Pacific coast points. As instances of this we note that 15,000 tons of wrought iron pipe have been shipped by the canal route from Youngstown, Ohio, to San Francisco. The all-rail price is 65 cents per hundred weight; by way of New York and by the canal it is 48 cents. Canned corn is being shipped through the canal from the Indiana canneries to the Pacific Coast, as is also cast iron pipe, sent from Alabama via New Orleans.

Road Models.—At the Fourth American Road Congress, held at Atlanta, November 9th-13th, the U. S. Department of Agriculture exhibited a complete set of models illustrating the construction and maintenance of standard types of roads. Included in this set were models showing the development of stone road building for 2,000 years past, among which were the Appian Way, representing an ancient Roman type of construction, samples of early French roads, the Telford, and early and modern Macadam roads. Other models shown illustrated questions of road location, bad alignment, improper grades, dangerous crossings, unsafe bridges and many other features necessary to understand when laying out good roads. The whole field of road building was covered, and it was the most complete educational exhibit ever attempted in this country. All of these models made on a scale of 1 inch to the foot, were large enough to perfectly illustrate their point. Besides the models an automatic projectoscope presented self reading lantern slides, while sets of motion picture films showed various construction scenes. This Congress was the most important and successful yet held, and accomplished encouraging work in the way of enlightenment and stimulating public interest in this important movement.

Science

Henry Gannett, of the U. S. Geological Survey, who died in Washington on November 5th, was the dean of American geographers, and a commanding figure in the scientific community at the National Capital. He was born at Bath, Me., in 1846, and educated at the Lawrence Scientific School and the Hooper Mining School of Harvard University. During nearly the whole of his professional life he was connected with the Geological Survey and its predecessor, the Hayden Survey of the Territories, having been chief geographer of the Geological Survey since 1882. He was especially identified with building up the admirable map-making work of that institution. Gannett wrote or edited a remarkable number of government publications which have become classical—such as the Dictionary of Altitudes (in several editions), the Statistical Atlases of the 10th, 11th, and 12th Censuses, the Manual of Topographic Methods, and a number of state gazetteers and geographic dictionaries. He was one of the founders of the National Geographic Society, and its president at the time of his death; chairman of the U. S. Geographic Board (formerly the Board o. Geographic Names); and a member of many learned societies. He served as director of the Philippine Census in 1902, and of the Cuban Census in 1907-08.

The Killing of Plant Tissue by Low Temperature is the subject of a bulletin recently published by Mr. W. W. Chandler, of the University of Missouri, which includes results of elaborate observations of his own, covering a period of about ten years, and also a resume of the work done by others in the same line. Exact information as to the conditions under which plant tissue freezes beyond recovery is urgently needed, to serve as the basis of efficient and economical methods of protecting fruit and other crops from frost injury. Much valuable work has already been done by Goeppert, Sachs, Muller-Thurgau, Molisch, Gorke, Lidforss, Maximow, and other Europeans, but comparatively little in the United States; hence Mr. Chandler's investigations are especially noteworthy. Some of the principal results are as follows: Most tissues are more likely to survive the effects of low temperature on account of a subsequent slow rate of thawing. The chief exceptions to this statement are ripe apples and pears, and the leaves of Agave Americana and lettuce. In the case of fruit buds, blossoms, and young fruit the rate of thawing appears to be of no importance. This conclusion differs radically from the belief of most horticulturists. Fruit buds and the newly set fruit resists cold better than the half-grown fruit. (This is stated especially of peaches). Although increase in sap density (strength of the sap solutions) increases the power to resist cold, and this can be effected by slow wilting or the partial withholding of water through a long period, it is found that rapid wilting has no such effect. The most important feature affecting the hardiness of plant tissue is maturity, i. e., the condition of resistance that the plants reach during the winter dormant period. Several other interesting conclusions are drawn from the voluminous observations made on a variety of fruits and vegetables, and the author suggests numerous practical applications.

Solar and Lunar Halos form the subject of several important memoirs in the July number of the *Monthly Weather Review* (issued in November), constituting, in the aggregate, the most substantial contribution hitherto made in America to the literature of this fascinating but neglected subject. Interest in phenomena of this class has been greatly stimulated by the wonderful display of solar halos seen at various points in the eastern half of the United States on November 1st and 2nd, 1913, and this particular display is described and discussed in the Review by Dr. Louis Besson, of the Observatory of Montsouris, Paris, who is probably the highest living authority on halos. The halos were especially well developed in Missouri and Arkansas on the 1st, and in southern Virginia on the 2nd, including such extremely rare features as the halo of Hevelius, the anthelion (a white mock-sun opposite the real sun in azimuth and at the same altitude as the latter; not the "anthelion" of the dictionaries), paranthelia, and especially the oblique arcs of the anthelion. Besson furnishes a tentative explanation of the last-named phenomenon, but the subject cannot be fully cleared up until more and better observational data are available. The same number of the *Review* contains a translation of a memoir by Besson on "The Different Forms of Halo and their Observation," the original of which was published three years ago in *L'Astronomie*. As a description of all known forms of halo and a manual for observers this memoir is absolutely unique, and fills a long-felt want; it will probably diminish the number of bungling reports of halos published in the scientific journals, in which these meteors are referred to as "rainbows" and otherwise described with no regard whatever for established terminology. Lastly, the *Review* contains a memoir by Andrew H. Palmer on "Halos and their Relation to the Weather," which furnishes the explanation of several common weather proverbs concerning "circles 'round the moon," and kindred phenomena.

Aeronautics

Life-Saving Garment for Aviators.—David Williams Ogilvie, of Balboa, Canal Zone, in a patent, No. 1,109,140 presents a life-saving garment especially designed for aerial operators and which has means for retarding a fall, means to cushion against injury from a fall, and float means to act as life preserver if the operator should drop in the water.

An Open and Shut Aerodrome.—In patent. No 1,109,648, to Wilhelm Kauertz, of Dusseldorf, Germany, is shown a hall for airships which is divided longitudinally into two halves opening toward each other and pivoted at their inner ends so they may swing apart and permit an airship to alight between them and then be adjusted together to enclose the airship.

An Automatic Aeroplane for War Purposes.—John Stasiak, of Seattle, Wash., has patented an aeroplane, No. 1,108,941, especially designed for use in war. It has an automatic control mechanism which can be set when the device is started on its journey and which predetermines the length of the journey at the end of which automatically operating means drop a bomb and automatically reversing and returning means are brought into play to return the aeroplane to its starting point and to shut off the power when such starting point is reached on the return.

Making Repairs 6,000 Feet in the Air.—While engaged in dropping bombs upon Antwerp one of the German Zeppelins was made the target for a Belgian battery, with the result that one of her propeller frames was badly damaged. This seriously interfered with the operation of the ship, and although it is said to have been 6,000 feet up, one of the mechanics of the crew climbed out on the injured framework, and in the course of half an hour cut away the damaged parts that prevented the machinery being operated. After this feat, while the ship was racing away at high speed, the same man repaired a long rent in the hull that had been made by a shell.

Awards in the English Aero Engine Competition. The result of the military and navy competition has been the awarding of the £5,000 prize to the Green Engine Company, which beat met the stringent requirements. This engine of 100 horse-power, has steel cylinders of 140 by 152 millimeters (about 5.51 by 5.98 inches), water cooled with copper jackets, and valves in the head operated by an overhead cam shaft. The total weight of this engine is 450 pounds. Eight other firms, whose engines successfully survived the preliminary eliminating run of six hours under full power, received awards of £100 each. These firms were Argyle (Ltd.); Beardmore Austro-Daimler Engine Company; British Anzani Engine Company, Dudbridge Ironworks Company, Gnome Engine Company; Green Engine Company; Sunbeam Motor-Car Company, and Wolseley Tool and Motor Car Company.

Wright Patents Recognized in England.—Word comes from England that the British Government has recognized the validity of the Wright patents covering certain features of aeroplanes, and has paid to the representatives of the Wright interests the sum of £15,000 to cover both past and future use of the devices protected. This settlement was brought about by the service of papers in the case on the Royal Aircraft Factory and Mervin O'Gorman its civilian superintendent making a claim of £25,000. The claim was recognized by the Government, and the above named settlement was made, the reduced sum being accepted not to embarass the Government in the present time of stress. This recognition of the Wright patents will, of course, open the way for proceedings against other constructors of aeroplanes, who will undoubtedly make satisfactory arrangements without contest. While the above results will undoubtedly be agreeable to Orville Wright, a recognition of this character of the pioneer work of himself and his brother will mean far more than any money payment.

Wing Covering for Aeroplanes.—Many different materials have been tried for covering the wings of aeroplanes, including linen, silk, cotton, celluloid films and aluminium foil. To the lay mind silk would seem the best fitted for the purpose on account of its lightness and strength, but it has been found not to withstand exposure to sun and rain as well as could be desired, and it does not lend itself to the application of the dressing compounds that are intended to shrink the covering tautly over the frames, and render the fabric proof against the weather. As the result of experience it has been found that linen is the best material thus far used, for, after it has received several coats of a solution of casein, which is the substance generally used for the purpose, the fabric is found to be stretched as tightly as a drum head, making a very smooth surface, which is of great advantage in fast flights, and the coating also increases the strength of the linen and renders it more enduring under varying weather conditions. It is estimated that such a coating increases the strength of the linen at least 5 per cent, and the cost is small considering the advantages gained.

The Naval Fights in the Pacific and Indian Oceans

Superior Gun-Power Wins Decisively in the Recent Cruiser Engagements



Date, 1904. Tonnage, 3,250 Speed, 23 knots. Guns: Ten 4-inch. Torpedo tubes, two 17.7-inch
I. Protected cruiser "Bremen."

Date, 1907. Tonnage, 11,600. Speed, 24.5 knots. Belt, 6-inch. Guns: Eight 8.2-inch, six 6-inch. Torpedo tubes, four 18-inch.
II. Armored cruiser "Gneisenau"; slightly damaged.

Date, 1907 Tonnage, 11,600. Speed, 22.5 knots. Belt, 6-inch Guns: Eight 8.2-inch, six 6-inch. Torpedo tubes, four 18 inch.
III. Armored cruiser "Scharnhorst"; slightly damaged.

Date, 1906. Tonnage, 3,250 Speed, 23 knots. Guns: Ten 4 inch Torpedo tubes, two 17.7-inch.
IV. Protected cruiser "Leipzig."

Date, 1908 Tonnage, 3,450. Speed, 24 knots. Guns: Ten 4-inch Torpedo tubes. two 17.7-inch.
V. Protected cruiser "Nuraberg"; slightly damaged.

THE GERMAN SQUADRON WHICH WON THE FIGHT OFF CHILE

ALTHOUGH thus far in the great naval war there has been no clash between the major units of the several navies, that is, between the battleships and battle-cruisers upon which must depend the final issue, there has been frequent contact between the lesser units—the armored cruisers, protected cruisers, gunboats, scout-destroyers, and last, but by no means least, the submarines. Although these engagements and the losses resulting therefrom have not been of such a character as to vitally affect the ultimate issues of the war, they have been full of dramatic interest; and if they have taught no new lesson, they have at least served to emphasize the truth of certain principles which have come to be accepted as sound among naval men

If it be admitted, as it must be, that the strategic success of the war as exemplified by the complete blockade of the German and Austrian fleets, and the sweeping of their commerce from the high seas, lies with the Allied fleets, it must in all fairness be admitted, *if we bear in mind the great preponderance of the British forces*, that the balance of the honors of the war in the engagements thus far fought rests upon the German fleet.

The most distinguished successes of the Germans, it goes without saying, are those which have been won by her submarine service, and we say this with full knowledge of the fact that since the British is the blockading force, its ships are more liable to submarine attacks than those of the Germans, who have been forced by necessity to remain within the shelter of the Baltic and their North Sea ports. The sinking of the armored cruisers "Aboukir," "Cressy," and "Hogue," and later of the protected cruiser "Hermes," has demonstrated that the Germans have developed a hitherto untried method of naval warfare to a high point of efficiency.

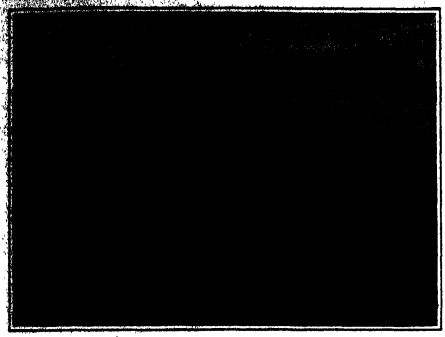
In the present article, however, we shall devote our attention to those engagements which have been fought out upon the surface of the water by that supreme weapon of attack, the gun—a type of weapon which, if we include its precursors the arrow, the javelin, and the bolt of the ancients, is as old as the history of naval warfare itself.

In the cruiser engagements which have taken place in the North Sea, and in the Pacific and Indian oceans, the outstanding fact is the decisive advantage which is held by the ship that carries the heavier battery. If we except the recent fight off the Chilean coast, these engagements have been fought, or mainly fought, between fast scout-cruisers and destroyers, carrying numerous batteries of the lighter guns, and in every case the ship mounting the larger gun, as was to be expected, succeeded in sinking or seriously crippling the enemy. Thus, in the fight off Helgoland, in which the opposing fleets, at least in the earlier phases of the engagement, consisted of scout-cruisers and destroyers, the British cruisers "Arethusa" and "Fearless," mounted 6-inch and 4-inch guns, and the German cruisers "Mainz," "Köln," and "Ariadne," mounted 4-inch guns. The official report stated that the "Arethusa," whose main battery consisted of 6-inch guns, contributed largely to the sinking of the German boats; although their final loss appears to have been due to their being drawn under the fire of the British battle-cruisers, when, of course, their destruction was inevitable.

Later, in the engagement off the Belgian coast, when four German destroyers were sunk by the "Undaunted," it was a case of the gun against the torpedo, and the 6-inch and 4-inch guns of the scout won out.

The most notable engagement of the war is that which was recently fought out off the Chilean coast, between two squadrons each composed of armored cruisers and protected cruisers. This was a gun fight pure and simple, and here again the heavier artillery won the day. On the German side were the two armored cruisers "Scharnhorst" and "Gneisenau," the scout-cruiser "Nurnberg," and the protected cruisers "Leipzig" and "Bremen," to which were opposed the British armored cruisers "Good Hope" and "Monmouth" and the protected cruiser "Glasgow." The action commenced apparently at about sundown, and continued for an hour or more until dark. Here, as in the actions in the North Sea, superiority in number of ships and weight of armament lay with the victorious fleet and the "Good Hope" was silenced, set on fire and sunk, the "Monmouth" being also crippled and set on fire, and, so far as the latest dispatches inform us, was either sunk or beached on the Chilean coast. The "Glasgow" escaped, and with the converted collier "Otranto" was later reported passing through the Straits of Magellan and making for the nearest British port. The armored cruisers "Scharnhorst" and "Gneisenau" and the scout-cruiser "Nurnberg" put into Valparaiso, and according to German reports had received little damage. The "Leipzig" and "Bremen" later reported at Valparaiso.

The interest of this fight centers in the armored cruisers. On the British side were the "Good Hope" of 14,000 tons, mounting two 9.2-inch guns and sixteen 6-inch, and the "Monmouth," mounting fourteen 6-inch guns. Against them the German armored cruisers could oppose sixteen 8.2-inch guns and twelve 6-inch guns. The two German ships were protected by 6 inches of armor; the "Good Hope" carried 6 inches of armor on her belt and the "Monmouth" 4 inches. The engagement was fought out in line ahead, with the ships steaming before a heavy head sea on parallel or slightly converging courses. A comparison of the respective broadsides shows that the British could oppose two 9.2-inch armor-piercing guns and seventeen 6-inch guns against twelve 8.2-inch, armor-piercing guns, and twelve 6-inch guns. The ships were running before a heavy northerly gale, and hence probably all of them were rolling heavily. So it is not surprising that the first salvo, delivered, according to some of the earlier reports, at eight or nine thousand yards, fell short. The first



Date, 1908. Tonnage, 9,800. Speed, 25 knots Guns: Ten 4-inch. Torpedo tubes, two 17.7 inch.

The scout-cruiser "Emden," destroyed by the Australian scout-cruiser "Sydney." Her remarkable cruise in the Indian Ocean, where she sank the "Jemtchug" and a destroyer and captured or destroyed some 25 or 30 vessels, takes rank with the exploits of the "Alabama" during our civil war.



Date, 1907. Tonnage, 3,400. Speed, 23.5 knots. Guns: Ten 4-inch. Torpedo tubes, two 17.7-inch.

The protected cruiser "Koenigsberg," which, during her cruise off the east coast of Africa, destroyed the "Pegasus" (repairing in Zanzibar harbor), and has now been blocked in and shelled by the "Chatham" on the German East African coast.

effective broadside seems to have been got home by the German cruisers at 6,000 yards, and, as the ships were on slightly converging courses, the damage to the British seems to have been done between this range and the range of 4,500 yards, at which the action ceased, darkness then coming on.

Now at 6,000 yards the British 9.2-inch, 45-caliber gun is capable of penetrating about 8½ inches of Krupp steel, and at the same range, the 8.2-inch, 40-caliber German gun is capable of just about getting through 6 inches of Krupp armor. Had the British gunners been able to land on the Germans, under the conditions of heavy roll existing at the time, the 9.2's should have been able to inflict punishment at seven or eight thousand yards. According to the dispatches, however, no hits were made until the ships were within the 6,000-yard range, when the "Scharnhorst" and "Gneisenau" let go salvos, aggregating twelve 8.2-inch guns, and landed with crushing effect upon the "Good Hope." Evidently, either her engines or her steering gear were crippled, and the British flagship slowed down. The "Monmouth" then moved up to cover the "Good Hope," and received the full broadsides of the Germans' heavy guns at ranges of 5,000 yards. At this range the 45-caliber, 6-inch guns, constituting the secondary batteries of the "Good Hope" and "Monmouth," can penetrate only 3 inches of Krupp armor. Therefore, their 6-inch batteries were unavailable, except against the unarmored portions of the enemy. The "Good Hope," on fire, turned to the westward, and apparently blew up and sank. The "Monmouth," on fire, disappeared, and either sank, or was beached. The "Glasgow" of 4,800 tons and 26½ knots speed, is a cruiser built in 1911. She mounts two 6-inch and ten 4-inch guns. She was apparently mainly engaged with the three German protected cruisers, which, like herself, were unarmored vessels. She could oppose a broadside of two 6-inch and five 4-inch guns against the united broadside of the three German vessels of fifteen 4-inch guns. What damage these lighter vessels inflicted on each other is not known. The fight establishes once more the crushing superiority of the big gun The "Drake" and the "Monmouth" were completed prior to the Japanese war The "Scharnhorst" and the "Gneisenau" were completed subsequently thereto in 1907, and they seem to show the influence of the all-big-gun idea as developed by that war The "Scharnhorst" indicates an intermediate phase of development between the "Yorck," mounting four 8.2-inch and ten 6-inch, and the "Von der Tann," with its main battery of eight 11-inch guns.

An interesting point brought out in the dispatches, is the fact that the "Good Hope" was rolling so heavily that her 6-inch battery on the berth deck was awash and could not be brought into action. This has been remedied in later ships, and the value of "high command" is now recognized.

The Cruise and the Destruction of the "Emden."

On the declaration of war a considerable portion of Germany's fleet of fast scouts and protected cruisers was scattered widely over the seven seas; and because of the preponderance of strength of the allied fleets, these widely separated units found themselves without any ports of their own or any friendly bases in which they might take shelter or to which they could repair for refitting and replenishment of stores and coal bunkers. Under the circumstances these ships made for the various lines of steamship travel, and proceeded to work such damage to the enemy's commerce as they might be able, before the ultimate and inevitable day of their capture or destruction arrived. Of the work of these commerce destroyers, for such they now became, that of the little "Emden" of 3,000 tons and 24.5 knots speed, carrying a battery of ten 4-inch guns, has been by far the most remarkable. A day or two before the outbreak of the war, the

(Concluded on page 429)



Date, 1908. Tonnage, 9,800. Speed, 23.5 knots. Belt, 4-inch. Guns: Fourteen 6-inch. Torpedo tubes, two 18-inch.

I. Armored cruiser "Monmouth"; put out of action by gun fire.

Date, 1911. Tonnage, 4,800. Speed, 26.5 knots. Guns: Two 6-inch, ten 4-inch. Torpedo tubes, two 18-inch.

II. Scout-cruiser "Glasgow"; escaped; reported at Magellan.

Date, 1902. Tonnage, 14,000. Speed, 23.5 knots Guns: Two 9.2-inch, sixteen 6-inch. Torpedo tubes, two 18-inch.

III. Armored cruiser "Good Hope"; sunk by gun fire.

THE BRITISH SQUADRON WHICH WAS OVERWHELMED IN THE CHILEAN FIGHT

Strategic Moves of the War

Letter from the Military Correspondent of the Scientific American, November 14th, 1914

The Campaign in France.

THE week has seen a continuation of the deadlock in the fighting in France. This close-quarter fighting between determined combatants is especially trying on the *morale* and results in large losses without apparent gains in position At all important points the lines have been pushed forward by dashes by night until the contending forces are within only a few hundred yards of each other. Here they burrow for protection against the intermittent storms of shrapnel and here they wait on guard either to repel possible attacks by the enemy or to muster strength for another surprise move to the front.

Sometimes these sallies catch the opponents off their guard sufficiently to drive out of their front trenches the troops that are left there as a garrison. The enemy then retains their trench lines in rear and rush forward reserves from the sheltered points in rear where they have been maintained for just such an emergency. The attacking force is checked along the second line of trenches or even along the third line, and both sets of combatants then proceed to modify their new positions so as to give the needed protection for firing trenches and also to construct the usual reserve lines of trenches in rear.

The above maneuver has occurred again and again during the recent fighting along the long battle line in France and Belgium Each side heralds its advance as a notable success and omits mention of its reverses. The actual status of the fighting is, on the whole, an even exchange of minor successes, with no change in the general positions.

The German campaign has been less aggressive since the capture of Antwerp, because of their effort to strike a telling blow at Russia. While they were diverting a large part of their strength to Russia, they were well content with an even break in France. The failure of their campaign in Poland was, then, a serious blow to their strategic plan of operations.

The Allies in the western theater of the war are also well satisfied to hold even for the present They have a superiority of numbers, but require time to provide the guns, ammunition, and other supplies that are needed to fully equip such immense numbers.

While they were unable to complete their preparation before the war broke out, they now have the advantage of the resources of the whole world to draw on for military supplies. The Germans and Austrians are, on the other hand, limited to home production or to supplies accumulated before the outbreak of the war In food supplies, clothing, and iron these countries should have little trouble in making good the waste of war, but in some minor items they will soon be confronted with a shortage

One of the important developments of the war has been the efficient service of automobile transport in moving supplies, guns, and troops Germany had apparently accumulated immense stores of spirits and gasoline at the outbreak of war, but it seems questionable whether any stock could long supply the enormous requirements of the many thousand automobiles that are now in service Germany's supply of gasoline and petroleum derivatives comes from three sources: Galicia, Caucasia, and America All are now shut off from the German market The large supply of alcohol normally obtained from grains and potatoes must now be largely reduced, due to the need of using these food products for subsistence Even if Germany and Austria are able to maintain their thousands of automobiles in usable condition, they are likely to find this service handicapped by shortage of fuel.

The copper shortage is especially important because copper bands are necessary for the projectiles Copper is also used for cartridge cases and for many important gun fittings. The most serious deficiencies that are likely to develop are those in nitric acid and in camphor. Both of these are essential for the manufacture of powder and both are obtained by Germany almost entirely from imported materials. While the supply of trained soldiers may make possible a war of several years' duration, it seems probable that the exhaustion of military supplies may weaken the German strength before the expiration of eighteen months Whatever the outcome may be, it seems improbable that the war will be decided before the end of next summer.

The only two concerted moves toward definite ends in the attacks and counter-attacks of the fighting in France are on the two flanks.

In Belgium the Germans gave up their attempt to force a way across the Yser River between Dixmude and the coast, due to the impossibility of moving artillery in the inundated districts. Farther south, though, in the vicinity of Ypres they have driven the French and British back five miles from their advanced position near Roulers. At the same time the Germans made spirited attacks against the French and British between Arras and Lille in the hope that the latter might have weakened their lines to send troops to the fighting on the flank. This latter fighting is probably the main effort of the Germans, the other fighting being demonstrations to divert the Allies' troops from the critical point. If the Germans can break through at Arras they will be on the short line to the coast. This is directly opposite their main line of communications *via* Namur and Liège; consequently to this part of the front they can most easily rush the large force needed for the successful prosecution of such a move. If the Germans should succeed in this attempt they would cut off the Allies' armies from Arras to the coast and might be able to capture a large part of their isolated forces. This is why the French and British are making such strenuous efforts to hold this part of their line. They cannot retreat from Arras without involving all of their left flank.

In the Woevre region, southeast of Verdun, the French have been unable to overcome the fire of the German heavy artillery. They have, however, maintained their positions on both flanks of the German salient at St Mihiel. The fighting power of the Germans is especially noteworthy in thus maintaining their hold on the Meuse River in spite of being surrounded on three sides by superior numbers.

On both the Lorraine and the Alsace borders the developments of the week were peculiarly gratifying to the French, though they have as yet little influence on the general military situation North of Nancy the French have advanced to the Seille River and the German boundary, occupying Nomeny, Champenoux, and Badonviller. From St Dié southward the French hold the summits of the Vosges Mountains, while in Upper Alsace they have captured Thann and Altkirch, eight miles east of the border. This move is as yet only a local success, due to the weak force with which this flank of the German line is held When the Allies have completed their operations for an aggressive campaign, one of their lines of advance will almost certainly be from Belfort down the valleys of the Ill and Rhine.

The Russian Campaign.

Events have moved rapidly in the eastern war zone. The Russians have developed a strength that exceeded the German and Austrian estimates and that bids fair to influence the whole war situation.

After the defeat west of Warsaw the Germans made a rapid retreat for fifty miles to the Warthe River, which here flows from south to north and parallels the German border When the Russians reached this line the Germans again fell back to the entrenched line along the ridge between Kalisz and Czenstochowa that forms the watershed between the Warthe and the Oder rivers Here they had carefully prepared a strong defensive line. By this rapid strategic retreat they secured the advantage of picking up their various garrison detachments and of regaining contact with their railway service, with the consequent facilities for forwarding reinforcements and supplies.

The Germans hoped that the Russians would press forward against this line. The latter would necessarily have to leave their heavy artillery behind and would have their strength cut down by the unavoidable losses of a rapid pursuit. Instead, the Russians slowed up their frontal attack and pushed forward a large army of Cossack divisions that, advancing *via* Kutno and Kolo, on the Warthe, have reached a point near Pleschen, fifteen miles northwest of Kalisz, where they threaten the German supply lines. If this force is strong enough to continue its threatening raid, the Germans will have no choice but to abandon their strong position between Kalisz and Czenstochowa

This defeat of the German army in Poland has likewise affected the developments in the other fields of fighting The East Prussian army has been called on to furnish guards for the Posen border. Consequently it has had to fall back to positions where its reduced strength would have better chance to withstand the Russians. The latter have pressed forward vigorously and have captured Lyck, Margrabowa, and Goldapp, ten miles west of the border. This retreat can be expected to continue, as the Germans have insufficient total strength to spare the force that would be required to maintain an advanced position in East Prussia.

Near Mlawa, where the railroad from Warsaw to Koenigsberg crosses the border, the Russians have also driven the Germans out of Poland. Along the Vistula the latter have retreated from Wloclawek to Nieschawa, half way to the border, while farther south, on the Warthe, they have again been driven back to the border, retreating from Konin to Slupsa. The initial success at Warsaw and its vigorous prosecution have then freed practically all of Russian territory from German occupation.

Against the Austrians the Russians have had equal success, though the former still retain possession of a small strip of Russian territory. The defeat of the German left caused them to call in their troops from the south. The Austrians were thus left unsupported and were forced to fall back rapidly from their position along the Vistula. Their first stand was made at Radom and Opatow, then next just north of Kielce. The retreat from this position in turn exposed the Austrian army along the San and forced it to keep pace in retiring. The Russian pursuit has pressed closely behind and has now carried them to Miechow, only twenty miles from Cracow.

The Russian advance in southwest Poland so threatened the rear of the Austrian army at Przemysl that it was forced to give way. The principal line of retreat of the latter is south of Cracow *via* the open pass leading into Moravia; so the Russian advance to Miechow threatens to interpose their army between the Austrian Galician army and their natural line of retreat. The latter, consequently, have had to abandon all of central Galicia to the Russians in order to save their army from disaster. By retreating to the west they steadily augment the strength of their forces in front of Cracow and correspondingly increase their chances of checking the Russian advance in this quarter.

This Austrian retreat has already enabled the Russians to advance to Rzeszow and Lisko, thirty miles west of Przemysl. Within a few days they will probably have regained the lines at Tarnow which they abandoned when the Germans made their great advance in the first week of October.

The Turkish Campaign.

The advent of Turkey into the war has had little immediate effect upon the situation, as both Russia and Great Britain had taken steps to protect their interests against this eventuality. Russia has retained her three Caucasian army corps in their peace locations on the southern border and Great Britain has concentrated a large garrison to protect the Isthmus of Suez.

Turkey has, on paper, an army of thirteen army corps, about 500,000 men. She must, however, keep a large force in Europe and the adjacent Asiatic provinces in view of the unsettled attitude of the Balkan States. It is hardly likely that she has more than 90,000 men to send against the Suez Canal, or more than 60,000 with which to oppose the Russian invasion of Armenia.

The British operations have so far been directed against Akaba, where the Turkish army is concentrating. The new Syrian railway leading southward from Damascus in this move shows its strategic value to the Ottoman Empire. Due to this supply route, she can now concentrate and maintain in this desert region many times the force that would otherwise be possible. For the defense of the canal, the British have 15,000 Australasians, besides British Territorials and many regiments from India. The British contingent from Kiaochow will also soon be available.

The Russian campaign against Turkey has consisted of an invasion of Armenia by an army of about 90,000 men from Batun, Kars, and Erivan in Caucasia. This army has now advanced twenty-five miles, half way to Erzerum, through a rugged country, devoid of good roads, that lends itself to defensive fighting. The Russian progress will, accordingly, be slow, but should result, in a few weeks, in the complete occupation of the border provinces of Trebizond and Erserum. The Russians will hardly advance much beyond this unless they more than double the force now operating in this region.

Mention has been made in dispatches of an advance by this route to Constantinople. Such a move would require 400,000 men and three months time. Long before this period elapses the command of the Black Sea will have been settled and Russia will be able to transport troops direct to the point that may be seized as a base for operations against the Turkish capital.

Scientific Journals and the European War

IN the SCIENTIFIC AMERICAN of October 17th we published a note to the effect that there was a dearth of foreign scientific journals owing to the European war. Several of our readers have called our attention to the fact that such a dearth no longer exists. As a matter of fact, while the note in question was still on the press, copies of foreign periodicals, particularly German journals, were coming into the office of the SCIENTIFIC AMERICAN. They are now received with considerable regularity, although necessarily somewhat delayed.

Letters from the Firing Line

The War in the Sky

By Aide-de-Camp Xavier Sager, Special Correspondent of the SCIENTIFIC AMERICAN at the Front

WHILE the public is particularly impressed by the exploits of the aerial battalions now engaging in war for the first time, it is important to state that in this enormous conflict of millions of men the few hundreds of aeroplanes and the few dozens of dirigibles which mingle in the fight, rarely play the part of the offensive. Outside of its given mission of fighting the sky battalion of the enemy far above the densely massed army, and dropping bombs on their hangars, the aerial offensive would be of little value in the conduct of the war. The aeroplanes and dirigibles would not be sufficient in themselves to destroy an army corps, but by means of them its movements are observed. The aeroplane in war is the eye of the army in the sky.

For reconnoitering the aeroplane is an excellent instrument on account of the tremendous spread of modern armies and the enormous length of the battle front. It must not be thought, however (as was thought at the beginning of the war) that its powers of observation are unlimited. Indeed, it is very difficult for an aviator who is flying at a great height to report the position of troops, to describe them and to estimate their number, especially as the enemy hides a part of his troops in the woods and masks his guns. The aeroplane does not pretend entirely to replace the cavalry scout. The latter will always be necessary to discern the physical and moral condition of the adversary.

In regard to the destruction of the aerial flotilla of the enemy, it seems that the aeroplane is particularly efficient against the dirigible because of its superior speed and its greater facility in maneuvering. For instance, the aeroplane will be able by flying over the dirigible to attack it with incendiary projectiles. A fight between two aeroplanes is more difficult and will, in most instances, prove fatal to one of the two adversaries. If either one wishes to avoid a combat his fate depends upon the speed of his machine, but it must be remembered that the aeroplane which is flying away is an excellent target for the pursuer.

So far it does not appear that we can expect very great results from the throwing of projectiles upon troops or fortifications or magazines. Recent experiences show the impossibility of securing exact aim. Dirigibles which fly at a lower level than aeroplanes and carry explosives of greater weight (ten magazines of ammunition) are assuredly more formidable. On the other hand, their volume and their relatively slow flight permit the adversary to fire at them with greater accuracy. It is very difficult for the soldiers on land to hit an aeroplane. Even the special guns which have been constructed for this purpose cannot be used with much accuracy when the target is flying above an elevation of a thousand meters.

The Germans have worked out some very skilful curves (I have just been studying them), which would seem to indicate that accurate training of guns at an aeroplane in flight is a problem easier to solve in theory than in practice. An aeroplane covering 120 kilometers (75 miles) per hour, flying very high and describing irregular curves in an atmosphere where the refraction of light produces curious visual errors, is a target as difficult to hit as a swallow in flight. There is, it is true, a shell designed to burn while in flight, leaving a trail of black smoke to indicate its trajectory, but by the time the gunner has corrected his aim, the aviator has sped far off.

Above the long lines of the actual battles, an aviator in quest of general information has no time to lose. All his mental faculties are at work: the position of the enemy, its number, how its troops are laid out—all this he must grasp at a glimpse, always prompt to avoid a shot, always ready to defend himself against any unexpected attack from the air or from the land. Helped by the information that the daring aviator has brought, the batteries start their fire, and the shrapnel does not go astray. In certain instances the aeroplanes have rendered valuable services to the cavalry.

It seems that up to the present moment the German aviators have not been as lucky as the French in their work of general aeroplane scouting; but they have shown great bravery and tenacity in the smaller reconnoiterings of the army. They come, they go, they glide, they turn, they come back in such a way that our troops exclaim: "One sees nothing but German aircraft," and they believe, quite wrongly, that the French aviator does not exist. They are mistaken. Nine times out of ten a Taube will draw back before our *avions*. If one of their "pigeons," venturing above the French lines, perceives one of our "corsaires," it flies back in great haste to its nest.

Lately, I witnessed the magnificent spectacle of a duel which took place 1,500 meters above us between two biplanes, one a French Voisin and the other a German Aviatik. At 8 o'clock in the morning the German biplane appeared, very easy to recognize on account of the great white crosses under the wings. At 9 o'clock the Aviatik passes again over our encampment, it is going back toward the German lines. Five minutes later a Voisin biplane, coming from the German lines, appears in the skies, first like a dot, and gradually becoming more and more discernible. We take our field glasses. We can plainly hear the noise of the two motors, and now the field glasses are unnecessary for we can follow the fight with the naked eye. The German biplane, in order to avoid the French had descended a few hundred meters. It is now flying at a height of about 1,200 meters. The French pilot rushes straight upon the German, keeping his machine higher than the enemy's. A few shots are fired from the French machine gun on board the Voisin. The German passes under the French aeroplane, trying to regain the shelter of his lines; it flies toward the north. The French, maintaining its elevation, turns on itself, describing a circle of a very small radius. It pursues the Aviatik, it comes nearer and nearer to it, it flies over it, it is ahead of it; then it turns, and coming back upon the German, it fires a few shots. In its precipitate flight from the French biplane the Aviatik describes many circles in the air. But the fight is on now; they have come together, and from both biplanes shots are fired. The German defends himself bravely. The two machines maneuver continually in the air, sometimes rearing like horses. The German loses some height, tries to regain it, and seems to be flying again toward the north, but suddenly it describes a short circuit and flies back upon the French biplane. The French machine gun fires repeatedly, the Aviatik pitches three times, sinks head first, and describes a spiral descent. The victorious biplane circles above the falling Aviatik, descending slowly over it, like a vulture over its prey. The Aviatik pitches to the ground a few hundred meters from us and we run to the spot. It has fallen in the swampy land near a large pond. The ground is so soft that our feet sink in to the ankles. The motor is almost entirely buried in the ground, the frame is twisted; the wings are shattered to pieces. One of the aviators, the pilot, has been killed; his body lies ten feet away. The second aviator has been caught under the motor, which is burning. It is red hot. We are helpless to give him assistance. He seems to try to untangle himself, but it is only a last convulsion, he looks at us; he clutches at the earth with his hands, and dies.

After the German biplane had stopped burning we came nearer. The motor was the only thing left, and we found a bomb which, fortunately, had not exploded.

The fight between aeroplanes is merciless. One of the two must perish. The aviators know it, and still they are eager to fight.

Are the Zeppelins to be feared? The Germans at the beginning of this war had placed great confidence in the activity of their dirigibles. Are they a grave menace to the security of the French and British armies? This has seriously been considered by our *état major*. Some schemes have been evolved, and many pieces of light artillery have been placed at strategic points, with the purpose of destroying the Zeppelins should they attempt a raid.

Concerning the efficiency of the Zeppelins, we have the official investigation made by competent authorities at Luneville, at the time that the "Zeppelin IV" landed there. From the speed entered in the log-book of the dirigible and after examination of the diagram of its flight, it appeared that the maximum speed attained was only 72 kilometers (45 miles).

Furthermore, the log-book referred to a load of 4,800 kilogrammes (10,582 pounds) for an ascensional force of 20,500 kilogrammes (45,194 pounds), that is, a proportion of 24 per cent, which is exceedingly small. The consumption of fuel was 135 kilogrammes (298 pounds) per hour. The supply was 950 kilogrammes (2,094 pounds), enough for a trip of seven or eight hours. To attain the height of 1,900 meters (6,234 feet) indicated in the diagram of its route, the Zeppelin had been obliged to throw off 3,000 kilogrammes (6,614 pounds) of ballast. As the equipment weighed 950 kilogrammes (2,094 pounds), the total weight was 4,900 kilogrammes (10,802 pounds). This is equal, and even exceeds somewhat the figure given; and this without guns, without armament, without ammunition. It is safe to say that a Zeppelin having to travel under military conditions—that is to say, in high altitude and with its war equipment—can carry a supply of fuel and oil which will last him not more than ten hours; and in case of head winds, even of the slightest, it will not cover a distance greater than 550 kilometers (341 miles).*

Suppose that a Zeppelin, starting from Metz, were flying toward Paris, the distance it would have to cover would be 800 kilometers (497 miles). During this trip it could not rise higher than 1,000 or 1,200 meters, which is not a sufficient height to protect it from the fire of our artillery. And then, the invulnerability of a Zeppelin is far from being what has been represented.

The bombs carried by the Zeppelins measure 1 meter and 20 centimeters (47 inches) in length and are 20 centimeters (8 inches) in diameter. Their weight varies between 100 and 110 kilogrammes (220 to 242 pounds). They are loaded with picric acid.

Bombs used by aeroplanes are exploded by the shock of impact with the earth or any hard matter. They are loaded with round balls. Their explosion is accompanied by a cloud of dense black smoke, acrid of smell; the same smoke that accompanies the explosion of certain German shells. These bombs are mounted like arrows and have a triangular arrow shaft or feather of steel. Practically the whole weight is in the head or body, so that the bomb will fall like a rocket and strike perpendicularly. The system of aiming is simple. While the aviator is in flight the bombs are suspended by a light thread, and the observer, on determining the point he wishes to strike, detaches the bomb without touching it, simply by cutting the thread.

When the vertical rudder of the aeroplane lies straight in the axis of the machine, the aviator aims, with an indicator affixed to the fuselage. This indicator is a small ring with a metal finger. When this is in line with the *target* the bomb will reach its mark.

The firing of guns is a thing almost impossible, the speed of the aeroplane being not always uniform and the wind being variable. The deviation of an aeroplane bomb, notwithstanding its weight (20 kilogrammes or 44 pounds) and the rapidity of its fall, may vary greatly. It is for this reason that the point aimed at is not generally reached, especially where the machine is flying at a high altitude.

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The Current Supplement

A VALUABLE feature of the current SUPPLEMENT, of the SCIENTIFIC AMERICAN, No 2029, for November 21st, is a very comprehensive article on The Care of the Wounded, which contains much interesting information on this important, but little understood, branch of an army in the field. It tells about the organization of ambulance and hospital corps, how the injured are found, treated and conveyed to the various hospital stations; the first aid packets carried by all soldiers in modern armies, and a description of the use of dogs by the Red Cross workers, together with numerous illustrations of these features and of a military hospital train. A comparatively new idea in aero work is the use of adjustable wings and a variable speed motor, and this is the subject of an article by an expert which will be appreciated by all interested in aeronautics. There is also a report of some new experiments on aeroplane problems by M. Eiffel, the celebrated French authority. The article on the design of floats for hydro-aeroplanes is concluded. In the article on muscular activity and thought processes, the writer reviews the various psychological theories that have prevailed, and makes an interesting addition thereto. The description, with illustrations, of a home-made electrical incubator and brooder, which most anyone can make, will delight every amateur chicken fancier. Other articles describe devices for regulating the flow of effluents or streams; a slow-speed electric motor; measurements of textile fibers, and information about fuel alcohols.

Prize for a Stump Puller

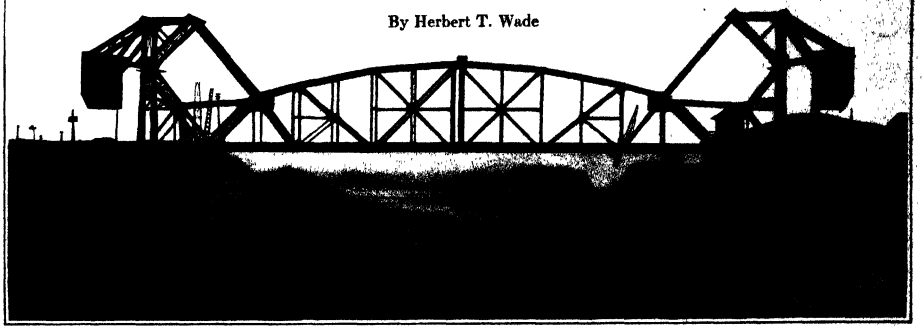
THE Craddock Agricultural Society of Cape Colony, South Africa, has offered a prize of £15 ($76.65) for the best, cheapest, and most effective means of pulling stumps ("stubbing," as they term it). The test will be held at the 1915 Show, and entries must be made by February 10th, 1915. Application forms can be had from the Bureau of Foreign and Domestic Commerce, Washington, D. C.

* It will be noted that these data relating to the Zeppelins differ from those which we have published in the SCIENTIFIC AMERICAN.

The World's Longest Bascule Bridge

How Two Folding Leaves of Huge Dimensions are Made to Form a Single Rigid Span

By Herbert T. Wade

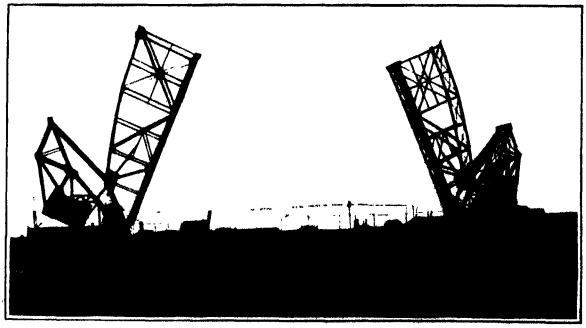


When the bridge is closed the leaves interlock and act as a simple span from pier to pier.

THE longest bascule bridge in the world, crossing the United States ship canal at Sault Ste. Marie, Michigan, now has been in successful operation for several months, and aside from its record size, it presents many interesting and novel points in design. It is 356 feet in length between centers of front piers, or 336 feet from trunnion to trunnion, and has two folding leaves, which, as shown in the illustration, interlock in such a manner as to form a single rigid span from pier to pier. This is the first time that this feature of bascule bridge construction has ever been accomplished, and naturally increases the length of span across which a bridge may be used. The Sault Ste. Marie bridge has its leaves of the Strauss heel-trunnion type, each leaf being formed of two riveted trusses 168 feet in length and 55 feet deep, spaced 20 feet apart on the centers. They carry a single track for the Canadian Pacific Railway, forming a portion of the International bridge across the St. Mary's River. The leaves are counterbalanced by heavy, overhead masses of concrete, which are suspended from counterweight trusses connected to the bascule trusses by parallel links. Each leaf with its mechanism is carried on a tower, the trunnion being located at the base of the framing carrying the bearing for the counterweight and counterweight mechanism.

The specially interesting feature of the new bridge is the arrangement made for allowing for expansion and contraction at one end of the span. This is accomplished by placing one entire tower with its leaf and counterweight on rollers, so that this end of the span is free to move when the bridge is closed, but when the opening mechanism is in operation the tower may be held stationary. When the bridge is lowered the bottom chords unite somewhat in the same fashion of an ordinary car coupling at a tension hinge which can be locked so that the two leaves are joined together, and under a live load act as a single span from pier to pier.

The bridge is operated from one operator's house by electricity, and may be opened and closed in 1¼ minutes. A hydraulic control with an oil pump enables the operator to adjust the position of the tower according to temperature. When it is realized that the superstructure is 426 feet long over all, including towers, the amount of contraction and expansion which must be allowed for can be readily appreciated. The entire structure contains about 1,400 tons of structural steel, and each bascule leaf with its floor system weighs about 400 tons. While the bascule bridge long has ceased to be a novelty, yet the features incorporated in the present structure are so unique as to have aroused considerable attention. The system of top and bottom chord locks at the center of the span provide for compression, tension, and shear, and have been so carefully arranged that a strong and homogeneous structure has been secured.



Bascule bridge across the United States ship canal at Sault Ste. Marie with leaves folded.

Economical Power

ALTHOUGH the economical generation of power has for many years been a theoretical proposition well understood among engineers, there are still too many plants where either the fear of "complication," or a lack of understanding of what can be easily accomplished, is keeping decidedly wasteful power plants in operation. In contrast with such is the equipment of the Ford Motor Company, at their new Detroit shops, which is probably the most elaborate and complete combination of economic methods and apparatus that has been installed in this country, and is a most interesting example of systematic utilization of practically the entire heat value. This outfit consists of units of a two-cylinder gas engine, arranged in tandem, and a tandem compound condensing steam engine, both connected to the same shaft, and capable of developing 6,000 horsepower.

It is well known that a gas engine works most economically when under full load, and it is, therefore, not intended to operate one of these units, of which there are *four*, unless there is at least half a load for it. Then the steam side of the unit will handle the extra load, which enables it to do all the regulating, it alone being provided with a governor, and no provision for governing is provided for the gas side. The steam exhaust is connected with a surface condenser, in which the vacuum is regulated according to the atmospheric temperature, and the warm circulating water from the condenser is passed through the heating system in the adjoining buildings. The exhaust from the gas engine side goes to a superheater located in the steam line between the high and low pressure steam cylinders, thus utilizing a portion of its heat to regenerate the steam before it reaches the low pressure cylinder. Another portion of the hot gases of the gas engine exhaust is passed through the jacket of the high pressure steam cylinder to prevent heat losses here, instead of using direct steam from the boiler, as is customary. All of the exhaust gases are then led to a feed water heater, through which all the water required for steam purposes passes. This feed water is first circulated through the jackets of the gas engine cylinders, where it reaches a temperature of from 150 degrees to 180 degrees, and in passing through the heater the water is raised to 250 degrees. It will be seen that for all practical purposes all of the heat generated is utilized, and the economy of the plant should be marked.

The gas engine side is of the four-stroke system, with cylinders 42 inches in diameter and 72-inch stroke, while the steam cylinders are 36 and 68 inches diameter and 72-inch stroke.

Award of the John Scott Medal

THE city of Philadelphia, acting on the recommendation of the Franklin Institute, has awarded the John Scott legacy medal and premium to Elmer Ambrose Sperry of New York, N. Y., for his gyro compass.

On battleships under action, the shifting of large masses of magnetic material precludes the use of the magnetic compass, and even in an ordinary iron vessel, the material of the ship and its disposition must be compensated for. The gyro compass is entirely non-magnetic and is unaffected by the proximity of iron.

For some years Mr. Sperry has devoted practically his whole time to overcoming the numerous physical difficulties involved in the adaptation of a gyroscope to a ship's compass in the place of a magnetic needle. He has been able to make an instrument which automatically corrects for the speed and direction of the vessel, and which is unaffected by the rolling of the ship in a heavy sea. His compass may be made in the form of a master compass which may be made to actuate secondary or repeater compasses mounted in any desired part of the vessel. On naval vessels such an arrangement is very desirable, as the master compass may be installed behind heavy armor plate and protected from damage, and may still be available when all the secondary compasses are destroyed.

Wirelessly-Controlled Beacons

A New Use for Hertzian Waves

By Major H. Bannerman-Phillips

It has been found necessary for the safety of ships that use which have to approach certain parts of the British Isles during their course to install beacons and fog-signals in isolated positions, the fog-signals to be sounded at intervals of about 30 seconds whenever the presence of fog renders such a warning of danger essential. A lighthouse with a tower containing motors, compressors, fog-horn and light, but quite unattended, although over a mile from the shore, was shown in the illustration with accompanying letterpress in the Platte Fougère lighthouse, off the coast of Guernsey, in the SCIENTIFIC AMERICAN of May 30th last, but this is connected by a submarine cable with the shore station, where the keepers and engine, etc., for the alternators are housed. The Clyde Lighthouse Trust also have an automatic beacon in the shape of a very powerful acetylene light at Garroch Head, which is unattended, but yet flashes at regular intervals all night and every night, but turns itself down automatically during the daytime.

Automatic Fog Guns.

They have further provided automatic acetylene gas-guns as fog-signals. These, once set going, would continue to feed and fire themselves at proper intervals until the fuel should become exhausted, which would occur only after several weeks. These guns are the outcome of an idea which emanated from Messrs. D. and C. Stevenson of Edinburgh, engineers to the Commissioners of Northern Lighthouses. They are of the utmost service to shipping in foggy weather since they not only warn passing vessels that they are near danger, but they can be regulated to fire at precise intervals, variable for each gun, and thus denote their whereabouts on the coast and enable the captains of ships to verify the approximate positions of their vessels at a time when visual observation may be impossible. Of course it would be wasteful and a nuisance to the public to have fog-signals going continuously when there was no fog, and similar arrangements to those at Platte Fougère could have been made to turn on the gas-gun with the coming of fog by submarine cable and turn it off again when the weather cleared. The expense, however, would be considerable, and although the gun itself is so constructed as to be unaffected by changes of weather, the cable might conceivably break down during a storm, and this would be doubly dangerous, because if it happened before the weather became foggy, the gun would not be firing when wanted, and shipping would be endangered by a false sense of security, for the captains of vessels, knowing the guns to be in certain positions, and not hearing the reports, would imagine they were clear of danger.

Wireless Control Suggested.

The automatic apparatus of the Garroch headlight was found to be susceptible to outside influences, and the Marconi's Wireless Telegraph Company was approached with a view to providing an installation which could be set going and turned at will from a distance in order to start and stop the firing of the guns.

Their research department accordingly set to work, and in a comparatively short time solved the problem.

It must be remembered that the difficulty of solution was increased by the fact that the apparatus in direct mechanical connection with the guns, that is, the "receiving" station, has to be left entirely without attention for long periods, during which it is not only exposed to the vagaries of climate and weather, but subjected from time to time to all sorts and conditions of signals from wireless apparatus from passing ships, which are far more powerful than the controlling signals, but which nevertheless must not be permitted to influence the "control." Moreover, the transmitting plant on shore, which actuates the district "receiving" station, has to be left in the hands of men who know nothing about the Marconi or any other wireless apparatus, and who must work the control on simple but definite directions involving no exercise of technical skill or knowledge.

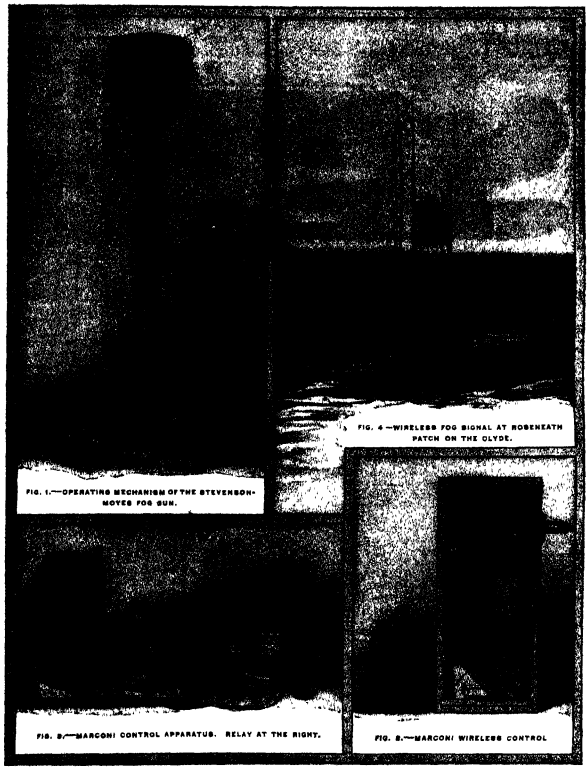


FIG. 1.—OPERATING MECHANISM OF THE STEVENSON-MOYES FOG GUN.

FIG. 4.—WIRELESS FOG SIGNAL AT ROSENEATH PATCH ON THE CLYDE.

FIG. 3.—MARCONI CONTROL APPARATUS. RELAY AT THE RIGHT.

FIG. 2.—MARCONI WIRELESS CONTROL

Wirelessly-controlled beacons.

How the Gun is Operated.

In order to illustrate how this is done, it is well to commence with a description of the Stevenson-Moyes acetylene gun, a drawing of which is given in Fig. 1. The gas is provided either by a carbide-to-water plant or from cylinders of acetylene dissolved in acetone, and is led through the stop-cock *B* into the expanding bellows *A*. As the gas enters, it opens out the bellows, driving up the rod *D*, and with it the inner container *E* of the air-gasometer (which is counter-balanced by the weight *C*), thus drawing air in through the air-box *F*. As *E* rises it drives upward the rod *I*, which performs two functions: The first is to wind up, against the action of a spring, an emery wheel in the ignition chamber *H*, which leads into the base of the gun *G*. The second function is to actuate a trip-gear which, when the container *E* has reached the correct height, suddenly closes the gas admission valve and opens another valve which allows both the charge of air in *E* and the charge of gas in *A* to flow together into the gun, in which they form an explosive mixture, correctly proportioned by the respective volumes of *A* and *E* (about 1:15). At this moment the rod *I* releases the emery wheel, which gives a vigorous half-revolution. Pressing against this wheel is the end of a rod of a special sparking metal *J*, forced down with uniform pressure by two weights. As the emery wheel gives its half-turn against the end of this rod it throws off a stream of sparks which fire the explosive mixture in the gun.

The muzzle of the gun opens into a chamber *L*, whose walls are composed of several concentric layers of metal net, each layer being spaced about half an inch from the next. These layers of net serve to keep the spray, even in the heaviest seas, from entering the muzzle, whereas they allow the explosion, reflected by the thick metal disk *K*, to pass out in all directions. The position of *K* above the muzzle is of importance, and an adjustment is provided by which this position is regulated and the gun properly "timed."

Action Automatic and Continuous.

As soon as the charges of gas and air from *A* and *F* have been passed together into the gun, connection with the latter is automatically cut off and the gas admission valve into *A* is opened, so that the whole process is repeated. The time occupied by each cycle depends on the rate at which the gas is allowed to enter, so that the number of signals fired in a minute can be regulated in this way.

It is clear that this process will go on repeating itself with perfect regularity until the supply of gas is exhausted, which would be in two, three, or four weeks time, according to the size of the generator. But by the installation of the wireless control gear the supply of gas can be turned on and off whenever desired, and as a result the gun can be left for a period of several months without attention, since it can be started whenever the weather becomes foggy and stopped as soon as it clears.

The Marconi Control.

The Marconi Company's wireless control is shown in Fig. 2. On the left of Fig. 1 is the Marconi gas-admission valve, which is introduced between the gas-generator of the Stevenson-Moyes acetylene gun and the stopcock *B*. This is a needle-valve controlled by two electro magnets, so arranged that when the first magnet is energized the valve opens wide and allows the gas to pass freely, while when the second magnet is energized, it shuts the valve firmly, so as to be gas-tight even against a pressure of 20 pounds per square inch—a valve considerably in excess of the maximum pressure in use with this gun.

Next to this valve is seen the water-tight metal box containing the wireless receiving gear, part of the box

(Concluded on page 430.)

August Weismann the Apostle of Germ Plasm

The Life Work of a Great Biologist Reviewed

By Benjamin C. Gruenberg

IN the evolution of evolution theories, the late August Weismann will have a place as the victor over what Darwin called "the Lamarckian nonsense." But he will be remembered for more than challenging the idea of transmission of parental modifications. His positive contributions to evolutionary thought have been receiving increasing consideration and appreciation in more recent years. The theory of the continuity of the germ-plasm, the theory of amphimixis as the source of variations, the theory of heredity resting on the concept of the germ-plasm, and the theory of germinal selection constitute, on the side of evolutionary thought, Weismann's chief contributions to the science of the last half-century. His studies in the development of flies and of water-fleas developed a technique for the study of embryology which has been of great value to other students, aside from the facts that he himself discovered.

August Weismann was born in Frankfort-on-the-Main, the son of a teacher of literature. He received his early schooling in his native town, and at 18 years of age he went to the University of Göttingen, where he prepared for the practice of medicine. This practice did not hold his interest, and a few years after getting his diploma he went to Giessen to study zoölogy with Leuchart. He was so successful in his studies on the embryology of the two-winged insects that he decided to apply his methods to other groups of animals. In 1863 he became professor of zoölogy at the University of Freiburg, where he remained for the rest of his life. Shortly after becoming a professor, his eyesight became so weakened that he was unable to use the microscope for about ten years. During this time it was necessary to suspend all research work, and most of his reading and writing had to be done with the help of others.

This period of enforced abstention from work with the microscope probably contributed very largely to the development of those speculations which form so prominent and distinctive a part of his life's work. In 1874, while resting at Lake Constance, he found a water-flea of a kind that was new to him, and was much impressed with its availability for microscopic study, on account of its transparency. At that time the modern microscopic technique was still in its infancy, and one was compelled to choose material for study not according to immediate needs, but according to the condition of materials that came to hand. Weismann decided to make a study of the Daphnids. In this group he worked out many of the physiological processes as well as the development and life-history, finding the relation of the alternation of sexual and asexual generations to external conditions. From these studies he passed to the eggs of the jellyfish, on which he published a monograph in 1883. In the meanwhile, in 1881, he had made a study of the relative length of life in different groups of animals, from which he concluded that the duration of life in any species was an adaptation to the conditions under which the species lived, and that physiological death was not a general phenomenon, since the lowest animals, the protozoa, never die except as the result of some violence. From this it was but a step to the idea of the germ cell, and then to the continuity of the germ plasm—ideas the development of which occupied his best thought for the next twenty years.

In practical consistence with his repeated demand that the Lamarckian system of thought, the assumption of the transmission of changes in the parents—or of "acquired characters," as they are sometimes called—be supported by suitable evidence, he himself started some experiments. After analyzing all the alleged evidence of such transmissions, and after finding that the removal of the tails from twenty-two generations of rats had no measurable effect on the length of tails still produced, he came to the conclusion that such transmissions have not been proven. This conclusion, though negative in form, was a real contribution to the progress of science, since it cleared the ground of a great deal of misconception and unwarranted assumption. His own experiments were followed by those of other workers, and so far the results, with the exception of some very recent experiments that have not yet been thoroughly analyzed, still support the negative conclusion that modifications in the body of an organism are not reproduced in the offspring. The fact that alcoholism does not show an influence upon the offspring can be explained on the Weismannian hypothesis without resorting to the Lamarckian explanation.

Weismann rejected the Lamarckian theory only partly on the failure of the evidence. From the nature of his own mind, the lack of evidence was not the chief obstacle. The impossibility of conceiving a mechanism that would account for the facts of organic inheritance and at the same time permit the transmission of modifications, was to Weismann the greater difficulty. Darwin's theory of pangenesis attempted to meet the requirements, but failed to do so. Weismann's original position was summarized by him as follows:

1. Acquired characters are such as result from external influences upon the organism, in contrast to such as spring from the constitution of the germ.

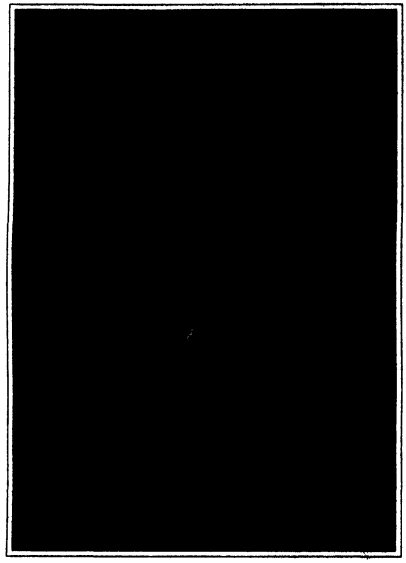
2. Characters can be inherited only in so far as their rudiments ("Anlagen") are already present in the germ-plasm.

3. Modifications which are produced upon the formed body in consequence of external conditions must remain limited to the organism in which they arose.

4. The same is true of mutilations, and of the results of use or of disuse of the parts of the body.

5. No such modifications of the soma (the tissues and organs of the body, as distinguished from the reproductive cells)—that is, such as are produced by the environment or by the functions of the organism—can be transmitted to the germ-cells, from which the next generation arises. They are therefore of no account in the transformation of species.

6. The only principle that remains for the explanation of the transformation of a species is direct germinal variation. These speculations led to the apparently paradoxical conclusion that the child is not the offspring of the *body* of its parent, but inherits its constitution and characters from the parental germ-cells; but these in turn owe their characters, not to the bodies which bore them, but to the germ-cells from which these bodies were developed. The body is, in fact, the offshoot of the germ-cell, not the germ-cell the offshoot of the body. According to this view the body is simply the *carrier* of the germ-plasm, which is self-perpetuating or "immortal," in the sense that it maintains its identity from generation to generation.



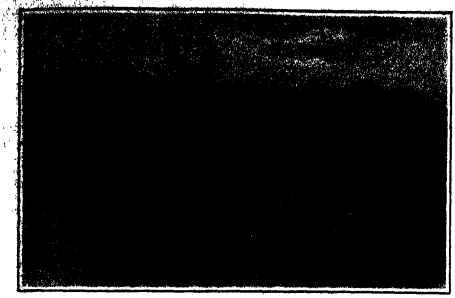
August Weismann

It must not be supposed that the idea of the continuity of the germ-plasm was altogether new with Weismann. It is one of those fertile aspirations that arise spontaneously in the minds of many men. This idea was first clearly expressed early in the nineteenth century by the anatomist Owen; later we find it in the writings of Virchow, the founder of modern pathology, who, in 1858, put it forth as part of his general doctrine, "All cells from cells;" it was also part of Haeckel's system of general morphology, as an incident to his doctrine of the continuity of parent and offspring, it was independently formulated by Nussbaum and by Jaeger, who in 1878 spoke of the continuity of the germ protoplasm which is inclosed within the body of the developing organism, but reserved to produce future generations. In this country, about the same time, the late W. K. Brooks gave expression to a very similar account of the function of the fertilized egg in producing on the one hand a series of cells that are to form the body of the individual, and on the other hand a series of reproductive elements that are to develop into later generations of organisms.

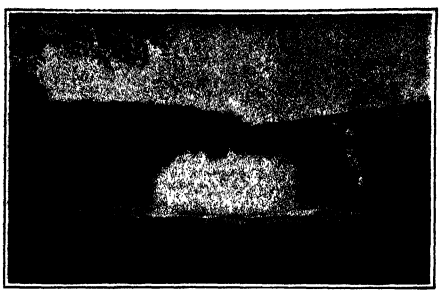
Weismann laid stress on the germ-plasm rather than on the germ cell, and he located this plasm in the nucleus of the reproductive cell. More specifically, the plasm must reside in the chromotin of the nucleus. Weismann pointed out that the germ-plasm must be conceived of as having a very complex structure, since it has been exposed for thousands of generations to the action of such external influences as may reach it through the vicissitudes of the organisms in which it has been successively carried. He postulated certain elementary biological units, the *biophores*, comparable to the hypothetical "gemmules" of Darwin, and the "pangens" of De Vries. These units were supposed to be combined into groups called "determinants," one of those corresponding to each cell or group of cells that constitute a definite character in the development of the organism. That is, the presence of a determinant in the germ-plasm determines a certain development; another determinant in its place would bring about a different character in the organism. These determinants are aggregated into still higher units, called "ids," each of which is supposed to contain a complete architectural outfit for all the characters of the species. These units are visible with the aid of a microscope, and correspond to the chromatin granules. A number of these ids together make up an "idant," and among them there is individual variation. The idants have been identified with the chromosomes.

Now, while this series of subordinate units may seem like a very complex and artificial system of speculations, it is significant that certain deductions made from these hypotheses have been verified by direct observation. In 1897 Weismann said that there must be two kinds of nuclear divisions, if his theory of the constitution of the germ-plasm was true. There would be first the division in which each chromosome is split lengthwise, so that each new nucleus receives an exact half of each id. Then there must be another kind of cell division in which the chromosomes are so split as to give to each new cell only one-half of the ids present in the mother-nucleus. The former kind of nuclear division was then well known to occur in the course of all normal cell division in the

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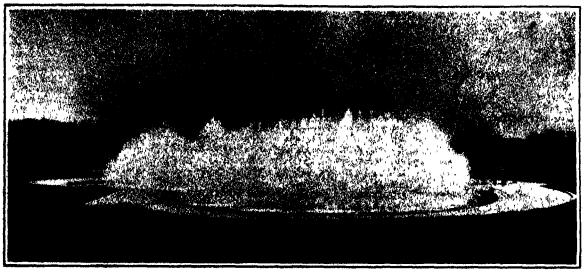
Kensico aerator basin, showing the nozzles and the central outlet slot.



The experimental aerator at the Rye outlet of the Kensico reservoir.

Mammoth Aerator for New York's Water Supply

ALTHOUGH, unfortunately, much of the magnificent engineering work on the great Catskill Aqueduct of New York city must lie buried far underground, there are many outcroppings here and there that will give the taxpayer some idea of the wonderful water supply system his money has bought. Undoubtedly the most spectacular features will be the two mammoth aerators, one at Ashokan, where the water may be purified before entering the aqueduct, and the other at Kensico, where the water may be purified again before entering the city. The latter aerator will undoubtedly come in for far more attention than the former, owing to its proximity to the city. Visitors will find it well worth their while to make the trip to this spot where the great aerator is in full operation.



The Kensico aerator as it will look when aerating the water of the Catskill aqueduct.

In a park setting, laid out by a landscape architect, is the enormous basin covering three acres, and measuring 400 feet in length by 240 in width at the widest part. The floor of this basin is studded with nozzles arranged in rows. There are 1,000 nozzles altogether, and when the aerator is in full operation each will spout a jet of water from fifteen to twenty feet high. The water will issue in fan-shaped, whirling fountains, which, owing to the close spacing of the nozzles, will intersect and break up the water into a mass of spray. Along the edges of the basin and at the ends of the rows of nozzles, there are groups of nozzles, some arranged to project a taller fountain than others, and all being designed to produce a very artistic effect. As the sun-light strikes the spray from these hundreds of fountains, it will be broken up into rainbows. By breaking up the water into spray, it will be brought into intimate contact with the air, which will thus oxidize some of its impurities. Aeration will be particularly needed in the fall when water, standing in lakes, is liable to acquire an unpleasant taste, due to microscopic vegetable growths. The one drawback to this spectacular feature of the aqueduct will be the odor extracted from the water by the air. This may be plainly noted in the small experimental aerator now in service just below the Rye dike of the reservoir. A photograph of this aerator is reproduced herewith.

One of the pictures shows how the large aerator will look when the water is turned on. Another is a photograph of the basin as it now looks, showing the rows of nozzles and the broad slot, covered with an iron grating, that runs down the middle of the basin, and through which the water will pour into the aqueduct. The water in the basin will be very shallow, as it will pour off quickly through the outlet slot. The aerator at Ashokan is almost identical in design and construction with that at Kensico, and requires no separate description.



An oil vessel moored outside the bar at Tuxpam and filling its tanks from a submarine pipe. The insert shows the land end of the pipe and the pumping station.

The Shipment of Petroleum at Sea by Submarine Pipes

MEXICO appears destined to become the world's principal source of petroleum. Rich oil fields, situated near the Gulf of Mexico, have been worked for several years, although the transportation, and especially the shipment of the oil, present great difficulties, due chiefly to the defective organization and equipment of the ports.

The principal ports of this coast are Tampico, Vera Cruz, and Puerto Mexico. Most of the oil is shipped at Tampico, but a considerable and steadily increasing quantity is exported from Tuxpam, the nearest point of the coast to the oil field of Potrero del Llano. Tuxpam possesses neither shipping facilities nor a breakwater inside which vessels can find shelter. Moreover, a bar like that of Casabianca sometimes prevents vessels from entering or leaving the harbor for several days.

The company that operates the wells of Potrero del Llano has adopted an ingenious device for overcoming these obstacles to the shipment of its oil. It has laid submarine pipes which, starting from the shore, cross the bar and terminate in flexible pipes, supported by buoys. The oil is forced through the pipes by pumps placed in a building near the shore.

The first installation

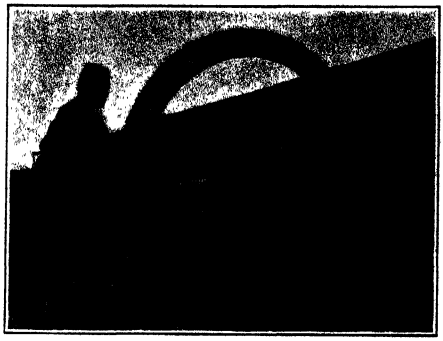
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Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

A Propeller-driven Unicycle

THE peculiar motor vehicle shown in the accompanying engraving claims a speed of 70 miles an hour, made in St. Louis, where it was built and tried out. The device is driven by an air propeller, which is operated by means of a gasoline engine. The big single wheel has a diameter of 81 inches, and is of aluminium, with a solid rubber tire. The rider sits on a saddle within the big wheel, and the frame which supports him, as well as the motor, propeller, gasoline, and oil tanks, etc., is suspended so that the wheel revolves about it, leaving the frame in the same upright position all the time. This is achieved by a system of fiber bearings in contact with the inner rim of the unicycle. Two rollers and a pair of skids are located at the sides of the big wheel, and their purpose is to keep it erect while at rest. When traveling, the device balances like a hoop, of course, and these lateral supports are lifted off the ground. No stranger sight can be imagined than this exaggerated hoop, bearing down the road at racing speed.



A unicycle driven by an aeroplane propeller.

Electrical Music

THADDEUS CAHILL, a well known Washington inventor, in patent 1,107,261, assigned to Ellis Spear and others, trustees, provides for producing music electrically and for distributing music electrically from one generating place or central station to many receiving points so that persons at their respective homes can hear and enjoy music produced at a central station.

Non-glaring Headlight

GLARE has been defined as a misplaced light; and blinding and glare effects from headlights are due entirely to improperly designed reflectors and unsatisfactory combinations of lamps and reflectors. Carl and Albert Matisse of New York have recently patented a sphero-paraboloid reflector which is shallow and which concentrates a beam of light within a small angle, but illuminates a wide area in front and extends well out to the sides of the reflector, and which is devoid of glaring effect. The reflector is ground from special glass into a concavo-convex lens (see Fig. 1). The convex-paraboloidal surface is silvered, in airtight contact therewith, and re-enforced with electro-plating of copper, and further protected by a non-corrosive, heat resisting paint. The exposed concave spherical glass surface cannot tarnish, and is easily kept clean without danger of injuring the reflecting surface, which makes the reflector substantially everlasting. The reflector confines the light reaching it, from a light source in the focus of the reflector, within a small angle of three degrees. Fig. 2 shows the result of a test by the Electric Testing Laboratories, New York, comparing the illuminating of this glass lens reflector with a metal one shown in Fig. 3.

The width of roadway covered by the light beam from the lens reflector is 10½ feet at 200 feet, and 31 feet at 600 feet. The lens reflector being only 3½ inches deep and 10 inches in diameter, with the source of light in the focus, only 33 per cent of the light is effective on the reflector, practically all of which is concentrated into the road beam. Sixty-seven per cent of the light from the source is available and used immediately in front and to each side of the reflector, whereby a wide area of illumination in front and extending well out to the sides is obtained. This light is vital for crossings and turns. For perfect adjustment of the source of light in the focus of the reflector, the source is mounted adjustably in the axis of the reflector. When utilizing the reflectors for automobile headlights, the source of light is mounted not only adjustably to the axis, but to be thrown out of the axis, whereby the beam of light may be directed upon the roadway within a hundred feet of the car.

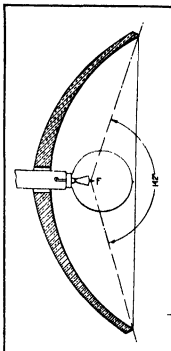


Fig. 1. The lens reflector in section

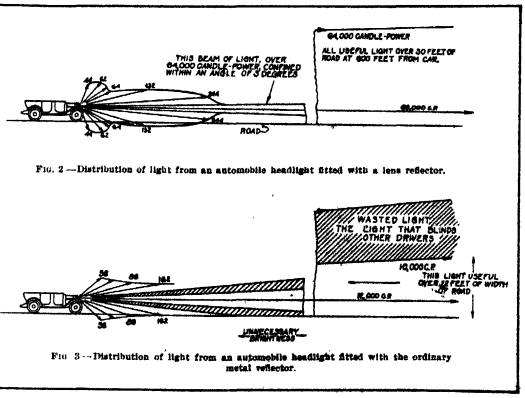


Fig. 2.—Distribution of light from an automobile headlight fitted with a lens reflector.

Fig. 3.—Distribution of light from an automobile headlight fitted with the ordinary metal reflector.

Illumination of a lens-reflector headlight compared with that of a metal reflector.

War and Patents in England.—One of the results of the war has been a very marked decrease in the number of patent applications filed in the British Patent Office. While the average number filed daily had previously been about a hundred, during the entire week ending October 3rd only 250 were presented. A considerable portion of this decrease is attributable to lack of money, but the number of men who have gone to the front, and whose attention is occupied in other directions, will account for many. Then again a great many applications came from foreigners, and these sources have been entirely interrupted.

Table Syrup from Apples

THE head of the fruit and vegetable utilization laboratory of the Department of Agriculture has, it is reported, applied for a public service patent covering the making of a new form of table syrup from apple juice. By this patent, the result of extensive experiments, the discovery, which the specialists believe will be of great importance to all apple growers as a means of utilizing their culls and excess apples, will become the common property of any cider mill in the United States which wishes to manufacture and sell the product.

The new syrup, one gallon of which is made from seven gallons of ordinary cider, is said to be of an attractive color, and, sterilized and sealed, will keep indefinitely, and is claimed will keep under household conditions as well as other syrups. Its flavor is described as similar to the taste of the syrupy substance which exudes from a baked apple.

A cider mill in the Hood River Valley, Oregon, will this fall undertake to manufacture and test on the retail market 1,000 gallons of concentrated cider, which will represent 5,000 gallons of ordinary apple cider with only the water removed.

Destruction of Private Papers and Checks

EVERY concern must find some method of disposing of its accumulation of private or confidential papers which have outlived their usefulness.

Many cumbersome methods have been devised and in some cases it is necessary for the treasurer of a company to have old voucher records carried to the furnace room, and he be obliged to stand by until the records are destroyed.

A large number of firms have adopted schedules, and they destroy vouchers five, six, or seven years old. Private correspondence has a limit of usefulness, as have orders, requisitions, etc.

There has now been provided for the treasurer's office a "macerating machine," which can be operated by hand or motor power. In operation the papers to be destroyed are fed into the machine from a table located at the top; upon entering a receptacle the papers come in contact with circular knives made of tool steel.

After passing the rotary knives the fragments falling by gravity through a trough into a box or other receptacle, are destroyed beyond all means of identification.

This method will no doubt find great favor with all business houses where it is necessary to destroy papers in any quantity, as the work can be done in the accounting offices without loss of time by the executives.

Adapting the Phonograph for Different Records.—Walter H. Miller of Orange, N. J., in patent No. 1,108,208, adapts a phonograph for use with various kinds of records, such for instance as those in which the groove is laterally undulating, and those in which the undulations are vertical, by supplying a plurality of reproducers, any one of which may be conveniently brought into operative position and in communication with the tympanum of the sound conveyor.

NOTICE OF

PATENTS

If you have an invention which you wish to patent you would be wise to communicate with us. We shall be pleased to advise you as to the best way of obtaining protection. Please send a sketch or a model of your invention and a description of the device explaining the operation.

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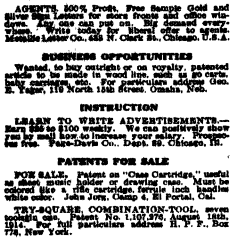
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TRY-SQUARE, COMBINATION-TOOL, seven models, can. Patent No. 1,107,370, August 18th, 1914. For full particulars address H. F. P., Box 776, New York.





The Naval Fights in the Pacific and Indian Oceans

(Concluded from page 381.)

"Emden" was coaling off Rangoon. A few days later she captured, took her coal aboard, and sank the "City of Winchester." A month later she turned up in the Bay of Bengal and captured and sank six vessels of from 5,400 to 7,600 tons. Then, after the lapse of another week, she was off Madras, where she dropped a few shells into the shipping of the harbor and bombarded and fired the oil tanks. At the end of September she captured four more vessels and sank them, using a fifth vessel as a ship for the prisoners. By this time several British cruisers had been sent in pursuit, but although they frequently caught sight of her, and captured her colliers and transports, she escaped them. Toward the close of October she carried through successfully a daring feat at Penang on Malacca Straits. Rigging up a fourth smokestack, and flying the Japanese flag, she steamed slowly, unchallenged, past the guns of the British fort, torpedoed the Russian cruiser "Jemtchug" and a French destroyer, and escaped unharmed.

Finally, after destroying between 25 and 30 ships, the "Emden" was caught by the fast Australian scout-cruiser "Sydney," sister ship to the "Chatham" and her class, and after a running fight, in which she lost two of her smokestacks and was set on fire, the "Emden" was driven ashore and burned.

The cruise of this vessel, her pluck, and her chivalrous treatment of the captured crews, have won for her the admiration of her enemies. In speaking of her destruction, the London *Times* said:

"We rejoice that the cruiser 'Emden' has been destroyed at last, but we salute Capt. von Müller as a brave and chivalrous foe. We trust his life has been saved, for if he came to London he would receive a generous welcome.

"Our maritime race knows how to admire a daring and resourceful seaman, and there are few episodes of modern naval history more remarkable than the meteoric career of the little 'Emden.'"

The "Koenigsberg" was reported about the same time as having been caught by the "Chatham" in a small inlet on the German East African coast in water too shallow for the "Chatham." A collier was sunk at the entrance, and the depredations of this ship were thus brought to an end.

The Shipment of Petroleum at Sea

(Concluded from page 427.)

consisted of two 6-inch pipes, of which one extended 3,600 feet and the other 5,150 feet from the shore. These pipes were laid by means of lighters. This method proved to be laborious and objectionable, as it caused some of the joints to leak. The newer pipes were laid by the following method: A runway, formed of heavy planking, with lateral guide rails or flanges, was constructed on shore, in the line of prolongation of the submarine pipe and at the level of high water. The sections of the pipe were assembled on the runway, which was as long as the whole pipe. When the sections had been joined the pipe was lifted and laid on carriages, placed 40 feet apart, each of which was mounted on a single wheel, nearly as wide as the runway. Before immersion the pipe was covered with two layers of canvas, coated with hot tar.

The pipe was drawn into the water by a vessel which approached within 1,600 feet of the shore and was attached to the pipe by a steel cable. When the submarine pipe was in position a diver attached to its outer end a flexible pipe composed of six sections, each twenty feet long, and fastened the end of the flexible pipe to a buoy. As the depth of water is only 43 feet, the length of the flexible pipe, 120 feet, is sufficient to allow its end to be brought on board a vessel without causing excessive tension. When the oil vessel is ready to fill its tanks it displays a signal to which the pumping station responds by starting its pumps. Six submarine pipes are now in use and two additional ones will soon be laid.—*La Science et la vie.*



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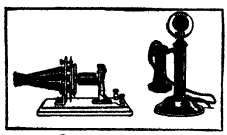


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How the Public Profits By Telephone Improvements

Here is a big fact in the telephone progress of this country:



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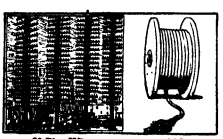
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Early Telephone Exchange — Typical Present-day Exchange

A three-inch underground cable now carries as many as eight hundred wires. If strung in the old way, these would require four sets of poles, each with twenty cross arms—a congestion utterly prohibitive in city streets.



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These are some of the familiar improvements. They have saved tens of millions of dollars.

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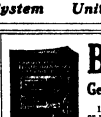
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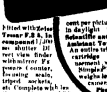
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Wirelessly-controlled Beacons

(Concluded from page 425.)

being removed to show the apparatus arranged on three shelves (Fig. 2.)

Connection to the receiving aerial is made through the insulator seen projecting on the right. The received signals pass to the "jigger" primary and thence to earth through a terminal passing through the wall. The "jigger" secondary goes to the actual detector—a special form of coherer seen on the right of the top shelf. This detector actuates a special relay (b) on the left of the top shelf, which is so constructed that, although very sensitive, it has a large movement, and is, therefore, capable of keeping in adjustment under all kinds of temperature conditions. This end is further insured by the provision of counter-balancing springs. This relay is seen on the right of Fig. 8.

The "Synchronizers" Play an Important Part.

On the left of this figure is seen one of the two "synchronizers," which form an essential part of the apparatus, rendering it perfectly immune from the two great troubles of "wireless"—atmospherics and "interference" from powerful signals from passing ships—and enabling the same apparatus to perform two distinct functions—turning "on" the gas valve and turning it "off."

Each synchroniser is connected to one of the two electro-magnets of the gas valve described above, so that when one synchroniser is actuated by the relay it energizes the one magnet and opens the valve, which remains fully open until the second synchroniser, actuated by the same relay, energizes the second magnet and closes the valve. A clockwork mechanism which runs for six months with one winding is included, and performs a useful and necessary function. Every ten minutes it operates a small hammer that strikes a sharp blow which jars the relay contacts, gets rid of any "stickiness" which might develop after several months, either in the pivots or at the contacts themselves, and at the same time causes a momentary current to pass through the decoherer.

The lower shelf contains in Fig. 2 the battery of dry cells which provides the driving power for the whole receiving apparatus. A small four-fold aerial, supported from a mast about 14 feet high, completes the receiving apparatus.

The Transmitting Apparatus.

The transmitting apparatus, installed on shore and under the charge of the coast guards, is simplicity itself. For short distances, such as 4-mile communication, it consists of a 10-inch coil driven off accumulators, a transmitting jigger and condenser and the transmitting "synchronizers" corresponding to those of the receiving set. For greater distances the same apparatus will serve, provided greater aerial height is available; failing this a small alternator provides the additional power required. Two sets of the apparatus just described are now working on the Clyde. One situated at Roseneath Patch, being shown in the illustration; and is operated from the coast guard station at Gourock. The other station is at Fort Matilda. Other sets are to be installed shortly, and the field opened for the application of this particular form of wireless control is so large that the company is busy designing sets for greater distances.

System Widely Applicable.

The article in the *Wireless World*, published by the Marconi Press Agency, from whom the details here given were obtained, makes the following suggestions: Putting aside for the present those applications which may be classed under the heading of "warfare" and keeping to those which deal with the preservation of life, it is suggested that in order to promote safety in mines, a small box, which could be carried by the miners as they progressed into out-of-the-way cuttings, in combination with a few feet of insulated wire, as aerial, would keep them in constant touch with the surface; so that, if the master alarm at the pit head were set going, the alarm would reach every part of the mine at once; or, if desired, any selected station could be placed instead, disturbing the workers in the rest of the mine.

In other spheres of usefulness many suggestions present themselves to every mind. Alarm signals for ships in fog, worked on a small separate aerial, and in no way affecting the ordinary wireless, would infallibly call the attention of the captain of a ship to the presence of another ship within a distance of say four miles, in a fog which may deaden the carrying power of the siren. All these form but a fraction of the possible applications which present themselves for this invaluable development of wireless control, which should have a beneficent effect on human intercourse in many ways.

August Weismann

(Continued from page 426.)

bodies of plants and animals. The second type was not known to occur, but Weismann predicted that it would be found to take the place in the formation of sperm-cells and in the separation of the "polar bodies" during the formation of egg cells. This type of division, which Weismann called a "reducing division," since it resulted in reducing the number of units in the daughter-nuclei to one-half the number present in the mother-nucleus, has been found to occur in so many of the plants and animals examined that it is now spoken of among biologists as the normal process in the maturation of sex-cells. Those who deprecate the speculations of Weismann as being "purely speculative" should give these theories the credit of being able to *predict*, which is the test demanded of all scientific theories.

The facts of nuclear division are of great importance in relation to a theory of sex, and it was in this connection that Weismann chiefly worked them out. It was his theory that the function of sex was to secure for a species a degree of variability through the combination of ids (with their determinants) from different sources. Since the number of these would double with each fertilization, leading to ever greater complexity of constitution, he was led to the theory of the linear arrangement of ids in the chromosomes, with the reduction of the number before fertilization, and a restoration of the number by the fusion of the two germ-cells. While in later study of the mechanism of the nucleus has borne out Weismann's theory at every point, his views on the causes of variation have not been supported by experiments. The application of mathematical methods to the study of variation has brought out the fact that the range of variation is as great among animals or plants that are produced without sex-fertilization, as among those in which "amphimixis" or the fusion of germ-plasm from two individuals does take place.

Weismann's theory of heredity is a part of the theory of the continuity of the germ-plasm, and of the constitution of the same. The germ-plasm is made up of biophores, self-propagating vital units, united into determinants. When a fertilized egg-cell begins to segment into cells that are to form a new individual, some of the germ-plasm is set aside to become later germ material of succeeding generations. Identifying the chromosomes with the idants, or chains of ids, makes the chromosomes the bearers of hereditary qualities. The same conclusions were reached at about the same time and independently, as a result of direct studies, by the botanist Edouard Strasburger and the zoölogist Oscar Hertwig. According to this theory there can be no "transmission of acquired characters," because there is no mechanism by which the effects of environment, of mutilations or of uses and disuse, can influence the germ plasm in a way that will change the determinants so that they shall *determine* development in the following generations corresponding to the parental modifications. On the other hand this theory does explain not only the fact of the reappearance of characters in parents and offspring, but also the fact of diversity; since the combination of ids is never the same in any two germ-cells. This theory is also in harmony with the recent discoveries in the laws of heredity based on experimental methods.

Weismann was a firm believer in the

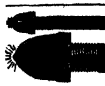
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Darwinian doctrine of evolution through natural selection, although he was ready to acknowledge that the theory, as Darwin left it, was far from adequate. In fact his whole life work may be considered an attempt to strengthen the weak points in Darwin's theory. The one point that seemed to him the weakest was the question of the origin of variations in just those directions that secure evolution in some definite line. He rejected the idea that there was something innate in living matter that compelled evolution along some certain lines rather than along others. His explanation rested on an extension of the principle of selection to the units that make up the germ-plasm. The theory of germinal selection supposes that the vigor and development of the ids depend upon the conditions of their growth, and that as there is competition among these units, the survivors will determine not only the character of the individuals that are to develop from the germ-plasm, but also the character of the germ-plasm of the succeeding generations. In other words, natural selection, by determining which individuals are to survive and leave progeny, also determines the character of the germ-plasm and the direction of variations. This theory, first suggested by Weismann in his famous reply to Spencer's essay on the inadequacy of natural selection, he considered a necessary complement of Darwin's theory, since only by its means could he reconcile the contradiction between the assumption of general fitness of organisms on the one hand, and the assumption of the origin of this fitness from accidental variations on the other. He admitted that primary variations must have been accidental, but insisted that continued variations must have been directed by some internal mechanism, once selection had begun to act.

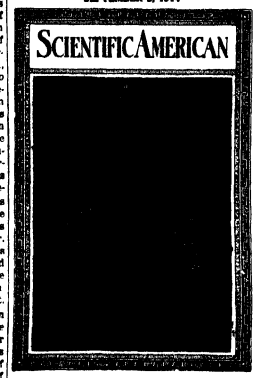
Weismann started his speculation upon heredity a firm believer in the principle of "epigenesis," or development under the influence of external conditions, as against the older, discredited theory of "Preformation," or the development of parts already existing in the ovum, but as his system of thought expanded he found himself obliged to reject the generally accepted epigenetic view and to work out a new phase of preformationism. The determinants of Weismann's system, although not actual miniatures of the parts of the organism, he nevertheless considered as *representative* units which are present in the fertilized egg from the very first, and which are transmitted to the offspring as stable units. But in applying the theory of determinants to the facts of regeneration, or the regrowth of lost parts, he found that he met the same difficulties as were opposed to Darwin's Gemmules. If, for example, it is the determinants in the cells of the lobster's claw that determine the development and size of that claw, how can the cells of the neighboring organs proliferate into a new claw when the old claw is removed? If the explanation of the facts is removed to the general properties of the lobster's protoplasm, the location of the injury, etc., then there is an abandonment of the determinants as the specific agents in clawmaking. If on the other hand we resort, as did Darwin with his gemmules, to Weismann's "accessory determinants"—that is, inactive claw-determinants lying dormant in the neighboring cells and becoming active only under the stimulus of the local injury—then there is an abandonment of the specificity of the determinants and a sliding back into epigenesis.

The determinant theory has the same difficulties to meet in the case of a segmenting egg which, when broken into its two or four or eight, or even more, several cells, will develop a perfect individual from *each* of the cells. According to the theory, the development of the individual is a process of differentiating divisions of the germ-plasm, in the course of which representative particles or primary constituents are distributed to make up the various parts of the organism. According to the facts, a small group of cells, as some cells of a begonia leaf, or of a willow stem, or of a piece of a hydra, may develop into a complete individual; or, as in the cases cited, a single cell, not itself a germ cell, may develop into a complete individual. What ever of truth there is in the concept of preformation has not yet been so formulated as to satisfy the rigid demands of the scientist.

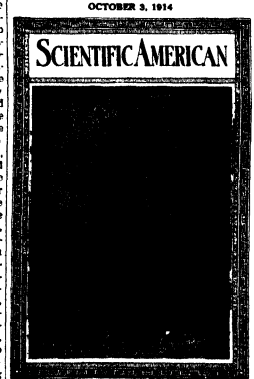
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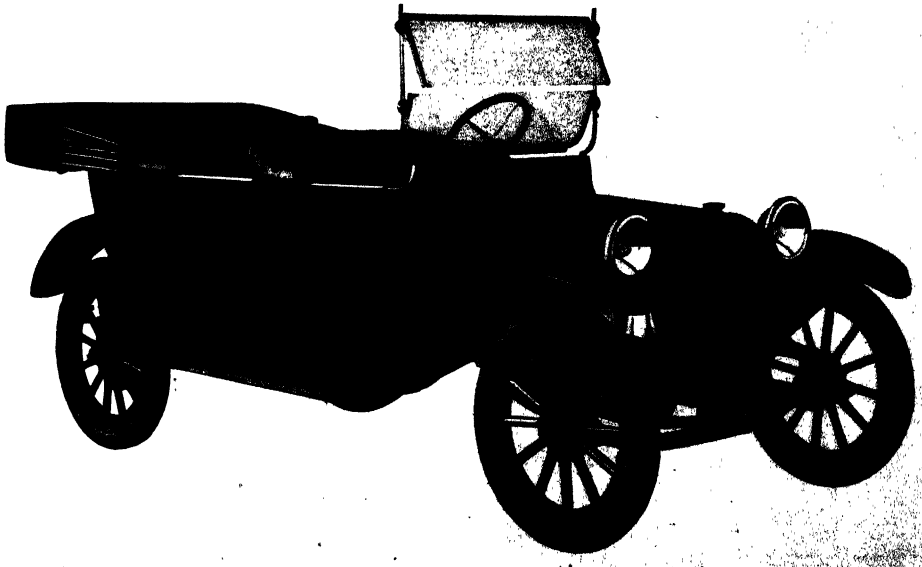
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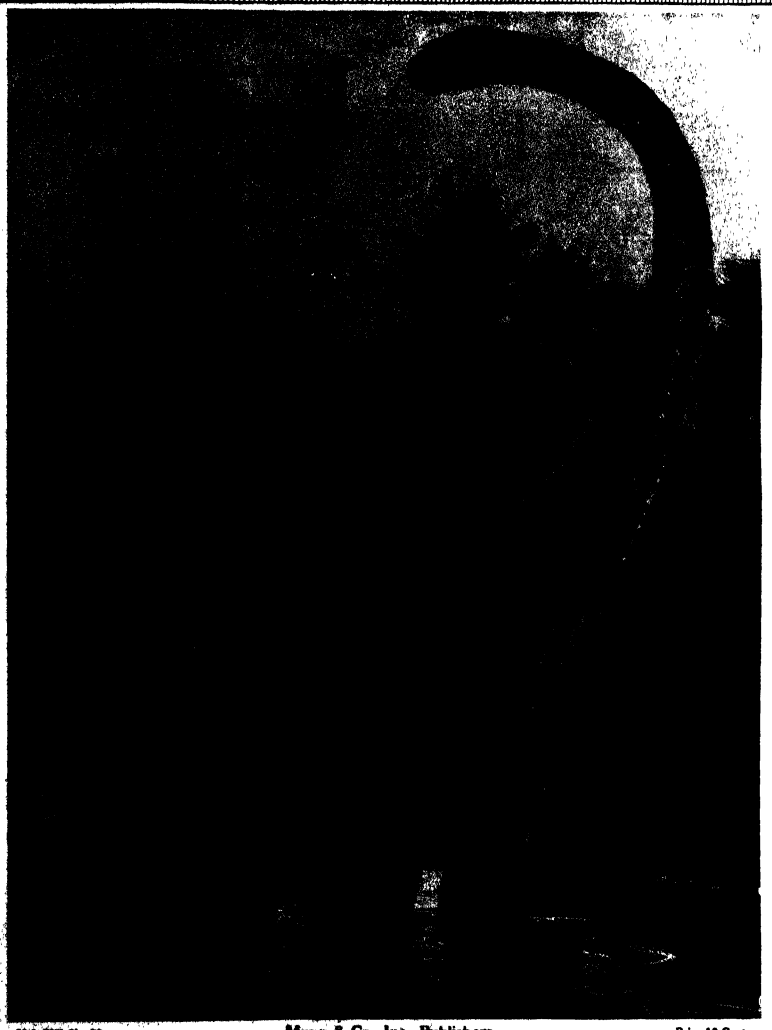
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The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Is Battleship Subdivision a Failure?

THE loss of the "Audacious" through contact with a mine has produced a sensation in the naval world which is comparable to that which followed the sinking of the "Victoria" several decades ago, through its being rammed by the "Camperdown." Theoretically the "Victoria" should have taken that blow, and, although injured, should have been capable of making port for repairs. Similarly, the "Audacious," of between two and three times her size and with an immeasurably better subdivision, should theoretically have been able to take that blow and survive it, creeping home, in a badly damaged condition, no doubt, but still in such shape that, after a few months in drydock, she would have been capable of taking her place, once more, with the fleet.

During the Russo-Japanese war, the mines took a fearful toll of the principal fighting units, both of the Japanese and Russian fleets. Nevertheless, it is a fact that there were occasions when a ship would bump into a floating mine, and yet would crawl into port, be repaired and join the line again in fighting condition. Thus, during the operations at Port Arthur, the battleship "Revnatopol" struck a mine on her starboard side, and some four hundred square feet of the plating and framing were driven in. Nevertheless, the ship got back to Port Arthur, and repairs were made, by means of a caisson externally applied, without the ship having to go into drydock. Some months later the same ship, when returning to Port Arthur from down the coast, again struck a mine, and by a curious coincidence she was damaged in almost exactly the same spot as before. This time, also, she managed to creep into harbor, and similar repairs were effected by the application of a caisson. These mines, however, must have been of much smaller size than the one which sank the "Audacious"; and the damage, although extensive on the outer hull of the ship, was localized in its effect upon the interior bulkheading.

Judging from the rapidity with which the armored cruisers "Aboukir," "Cressy," and "Hogue" sank after being torpedoed, it is probable that the Germans are using unusually large charges in the torpedoes which are carried by their submarines. Because the submarine can get within closer range of the enemy before launching its torpedoes, the latter do not have to travel through the great distances, and at the high speed which is necessary in torpedoes launched from battleships, cruisers, or even from destroyers. Some of the weight given up to air reservoir, motive power, etc., can be assigned to the explosive charge, which is made very much larger. It is possible that the German submarine torpedoes are carrying as high a charge as three hundred pounds of the most powerful explosive.

There is no hard-and-fast restriction governing the weight of charge that can be placed in a mine; and, judging from the results achieved in the case of the "Audacious," it is likely that the mine which sank her carried at least five hundred pounds of explosive. If we bear in mind that the destructive effect of the detonation of a mass of explosive varies as the cube of the charge, it can be realized how great was the disrupting power of the enormous volumes of gas which were let loose within the interior of the ship at the moment of detonation. The water on the outside of the ship being incompressible, the force of the explosion would seek the path of the least resistance, which naturally would lie through the comparatively frail structure of the ship; and it must be understood that the destructive energy would not be limited merely to bursting in the side plating and framing, but would be continued in the form of an enormous volume of gas under high pressure, suddenly putting under heavy stress the closed compartment or compartments immediately affected. It can be readily understood that the pressure thus engendered might be sufficient to start the seams for a considerable distance along the side of the ship, and to loosen up, not only the seams of the adjacent bulkheads, but also the edges of the bulkheads where they are attached to the inner bottom, the sides and the decks of the ship.

Experience in the testing of bulkheads on warships has shown that while they will remain tight under a head of 35 feet, or say 15 pounds, to the square inch, leakage will develop when the depth or head reaches 40 feet. Ordinarily bulkheads are designed to withstand a head or immersion of 35 to 37 feet. Now it can readily be supposed that the pressure of the gases thus expanded within the ship may have greatly exceeded the safe limit of 15 pounds; and, if so, although the bulkheading may not have been broken away, serious leakage may have been started throughout a considerable area of the interior of the ship. This leakage would be slow but sure; and it was probably this gradual inflow, impossible to prevent, that brought about the gradual loss of buoyancy of the "Audacious," which appears to have remained afloat for about thirteen hours after the blow was delivered.

Undoubtedly the disaster will cause naval constructors the world over to revise or greatly improve their present systems, already most elaborate, of subdivision. Lately the French have suggested that provision be made for limiting or checking altogether the inrush of gases by providing an interior longitudinal wall of armor, inwardly curved so as to present a concave face to the explosion. This would mitigate those leakage effects which take place when a plane vertical bulkhead wall is exposed to excessive pressure.

Let it not be imagined for a moment that this disaster in any sense seals the fate of the battleship. This still remains, and for many years to come must remain, the principal arm of a navy for winning decisive results. It must be borne in mind that, had it not been for the heavy sea that was running and the fact that the engines of the "Audacious" were disabled, she could have been brought back to her naval base, either under her own power or by towing. As it was, she was unable to move, and the heaviest towing cables made fast to the "Olympic" snapped like threads in the heavy scend of the sea.

Sources of Commercial Potash

WITH the check to imports of German potash caused by the war and the consequent rise in price of all potash salts, American manufacturers may find it necessary to consider domestic sources of supply.

Most of the potassium compounds used in pharmacy to-day are derived in the first instance from the famous salt deposits of Stassfurt, Germany, where the element occurs as potassium chloride, in the mineral called silvine, and as magnesium-potassium chloride in carnallite. The "potash" of commerce is obtained by the leaching of ashes from land plants, the ashes of sugar beets from molasses residues, and in the purifications of sheep suint. The product of wood ashes is purified by repeated crystallization from hot water and enters the market as "pearl-ash."

In a recent issue of the SCIENTIFIC AMERICAN, a correspondent drew attention to beet-sugar molasses as a source of commercial potash and suggested that the production of potash salts from beet-sugar refuse might be profitably carried on in this country.

The French sugar-beet sugar contains a notable proportion of potash salts, and the recovery of potash from the waste material of the stills used in treating beet-sugar molasses was an industry of some importance prior to the introduction of German potash, which became available in far greater abundance than was possible with beet-sugar refuse.

It may, therefore, be opportune to direct attention to early efforts in this country to provide material for the manufacture of potash salts. In a paper contributed to the American Pharmaceutical Association in 1892, Prof. John Uri Lloyd recalled the fact that American potash was formerly an article of much importance, and was exported from this country in large quantities. Years ago a well known American firm manufactured yellow prussiate of potash on a large scale. In the beginning of the work the crude potash was obtained principally from Michigan from forest stumpage, the ashes of the stumps being collected and leached in the final clearing up of the land. This potash, as shown in the paper by Prof. Lloyd, already referred to, was, as a rule, mixed with more or less common salt, in some instances being extraordinarily adulterated. The German potash, both carbonate and caustic, came along about the time the Michigan source was exhausted, and has continued to be used in chemical factories generally. Now that a survey of German supply impends it would seem that there could be an opportunity for the development of potash manufacture as a by-product of the beet-sugar industry, provided the American molasses of the beet contains the same proportion of potassium that was evidently present in the French sugar beet. Prof. Lloyd states that his firm used considerable quantities of beet potash imported from France, and the material was vended to the German as a basic substance for the manufacture of yellow prussiate of potash, though, naturally, the supply was somewhat irregular. Prof. Lloyd thinks it likely that the crude molasses of the South contains an abundance of potash, which, if there is a continued famine in German potash, might well be investigated.

Meanwhile, it is encouraging to note from a recent statement by Secretary Lane of the Department of the Interior that the home production of potash will be started at a plant in Searles, Cal., at an early date. The initial output will be only five tons a day, but the plant under construction is expected to ultimately produce 120 tons.

Edison's Clearness of Vision

WHILE the public at large are willing to give credit and praise to the inventor for his brilliancy of thought and originality of conception, as well as the persevering and painstaking research that often accompanies the development of a great and useful invention, yet it is not so frequently that it recognizes the clear and logical order of mental processes which are essential in such work. The inventor first has to appreciate the need which exists for some method or device, and then he contrives to fill this need as satisfactorily and efficiently as possible. It is, in short, a process of imagination, and the man with the most active imagination which can be controlled and directed into proper channels, will be the benefactor of the human race in science and industry, as well as in art, literature, and politics. Often this imagination will run far in advance of the realization of the inventor's ideals. Some far-seeing philosopher may visualize the future, but may be utterly deficient in mechanical skill or practical knowledge to carry into practice the visions he has conjured up. On the other hand, the really successful inventor not only is a man of vision, but one able to reduce to practice to the benefit of mankind his imaginative efforts.

A striking example of this may be seen in connection with the efforts of that great American inventor, Thomas A. Edison. Some of his recent appliances were described in the SCIENTIFIC AMERICAN of September 12th last. In 1876 the speaking telephone was exhibited by Bell at the Centennial Exhibition. In 1877 Edison brought out the phonograph, which was introduced to its first large circle through the pages of this journal. In the following year, 1878, Mr. Edison wrote describing the phonograph in an article which appeared in the *North American Review*, and which enumerated ten important uses this new invention would have. One by one mechanical ingenuity has brought to the public these important utilities in all save one respect, namely, a device for recording effectively a telephone conversation. That Mr. Edison realized the importance of this as well as the possibility is clearly indicated by the following extract from the article referred to:

" . . . *Lastly*, and in quite another direction, the phonograph will *perfect the telephone*, and revolutionize present *systems of telegraphy*. That useful invention is now restricted in its field of operation by reason of the fact that it is a means of communication which leaves no record of its transactions, thus restricting its use to simple conversational chit-chat, and such unimportant details of business as are not considered of sufficient importance to record. Were this different and our telephone conversation automatically recorded, we should find the reverse of the present status of the telephone. It would be expressly resorted to as a means of perfect record. In writing our agreements we incorporate in the writing the summing up of our understanding, using entirely new and different phraseology from that which we used to express our understanding of the transaction in its discussion, and not infrequently thus begetting perfectly innocent causes of misunderstanding. Now, if the telephone, with the phonograph to record its sayings, were used in the preliminary discussion, we would not only have the full and correct text, but every word of the whole matter capable of throwing light upon the subject. Thus it would seem clear that the men would find it more advantageous to actually separate a half mile or so in order to discuss important business matters, than to discuss them verbally, and then make an awkward attempt to clothe their understanding in a new language. The logic which applies to transactions between two individuals in the same office, applies with greater force to two at a distance who must discuss the matter between them by the telegraph or mail.

No more impressive or clearer statement of the deficiency of the telephone could have been written after thirty-five years of its active use. Essentially simple, yet practically difficult of realization, an instrument to meet this need has been developed by the efforts and painstaking exertion of Mr. Edison and his engineers, and we have to-day the new telescribe, or telephone recorder, as the result both of a brilliant inspiration and the logical development of a need seen by the prophetic vision of the great inventor.

Science

The Macassar Oil Nut.—This curious fruit of the Proteaceæ, which occasionally grows on trees bearing ordinary macadamia nuts, is described from the Philippines by R. E. Gonzales y Sioco. Instead of containing the ordinary watery "milk," the macaspuno nut is nearly or quite made up of a viscous, white, translucent jelly, the texture of which next to the shell approaches the firmness of the normal cocoanut meat. There is no way of distinguishing this kind of nut, when intact, except by shaking it. It is said that trees which bear macaspuno nuts will continue to do so from year to year.

A Deep Boring in Texas.—In an unsuccessful effort to find water for the town a boring to a depth of 4,489 feet was recently carried out at Spur, Texas. This boring gives interesting information concerning the stratigraphy of the region. There are three well-marked divisions. From the surface down to a depth of 1,250 feet are found red sands, clays, marls, beds of gypsum, anhydrite, and salt, including three beds of pure salt, ten, five, and nine feet in thickness. The next 2,850 feet consist of dolomite, with strata of anhydrite, sandstone, and shale. The lowest 389 feet are limestone and shale.

Preserving Mulberry Leaves in Cold Storage for the use of silkworms has recently been investigated in Italy by P. Buffa, who reports excellent results under the following conditions: The temperature of the storage chamber should be constant between 33.8 and 35.6 deg. Fahr. It is best to precool the leaves for a few hours before putting them into the chamber. Free ventilation should be allowed in the boxes, which should not be of greater capacity than about 3 cubic feet. The stored leaves were eaten with as much relish by the silkworms as fresh leaves, and gave exactly as good results.

Aerial Tubers in Potatoes are described by Th. Foitik in a German agricultural journal. They were observed on three varieties, occurring on the main stem or branches, singly or in clusters. They are grass green with purple spots, and often bear nodosities from which, or from the tubers themselves, rosettes of soft leaves may arise. Some are as big as pigeons' eggs. The tubers form especially on haulms which have been bent down to the ground, and appear to be favored by heavy fertilising and damp weather. The writer planted some of these aerial tubers, and obtained from them yields heavier than the average of the variety.

Velocity of Wireless Telegraphic Waves.—An interesting paper has been read before the Academie des Sciences in Paris describing experiments undertaken to determine the velocity of propagation of the waves used in wireless telegraphy. A station A_1 emits a signal to which another station A_2 replies by a second signal. At the station A_1 one notes the time T_1 which elapses between the departure of the first signal and the return of the second. In the second station A_2 the time T_2 is noted between the reception of the first signal and the emission of the second. Obviously T_1 is greater than T_2 and their differences $T_1—T_2$ is the time taken for a signal to pass from the station A_1 to the station A_2 and back again. Three experiments were made: from Paris to Toulon, Paris to Toul, and Paris to Washington. The method employed to measure time enabled one to measure precisely an interval of one hundred-thousandth part of a second. It was found that wireless telegraph waves are propagated along the surface of the earth with a velocity slightly inferior to that of light.

Ice Fringes on the Stems of Plants.—This curious phenomenon occurs on plants of comparatively few species, and appears not to have attracted much attention. It has, however, been described, with attempts at explanation, by Sir John Herschel, John Le Conte, and a few others. In the current *Journal* of the Franklin Institute an interesting discussion of the phenomenon is published by W. W. Coblentz, of the U. S. Bureau of Standards, who reports the results of his own observations on the ice fringes of dittany (*Cunila mariana*). The fringes form in freezing weather, especially in the autumn, in the form of delicate loops, ribbons, or curled plates of thin ice, which are evidently not a form of hoarfrost, as the amount of ice is much in excess of that which could be condensed out of the atmosphere. The moisture is undoubtedly supplied by the plant itself, but the mechanism of the process was obscure prior to Coblentz's observations. These seem to prove that the moisture is exuded from the stems by capillary attraction, and the phenomenon is therefore similar in origin to the ground-frost formed on the surface of wet soils, except that in the latter case a particle of gravel usually forms the nucleus to start the congelation. When the moisture within the stem is frozen fringes cannot form, nor do they occur when the ground is frozen to the depth of an inch or more. The size of the ice fringes and the height to which they extend above the ground depend upon the rate of evaporation from the stem and upon the amount of moisture in the ground. Fringes form most readily and abundantly on stems having a great number of cap-tubes; differences in the anatomy of their stems explain why some species form fringes while others do not.

Automobile

English Motor Car Show Abandoned.—For the first time in a number of years, there will be no show of motor cars in England in 1915. The energetic fashion in which the warring nations have been pushing their hostilities is responsible for the abandonment of this annual function at Olympia.

Mirrors on Commercial Vehicles in New Jersey.—By way of increasing the safety of pedestrians and the occupants of other cars, the New Jersey legislature has ordained that after January 1st, all commercial vehicles must carry mirrors which will afford their drivers an unobstructed view to the rear.

"Light Car" Coming into Vogue.—It is a noteworthy and significant trend of the times that the term "cyclecar" as applying to small, narrow-tread vehicles, is passing. Such vehicles in the majority of cases now are termed "light cars" by their makers, and it might be added, the new designation is the more becoming and the more suggestive of the vehicle itself, of the two.

Foreign Motor Car Shows Abandoned.—As might have been expected, the foreign war situation which is tearing at the vitals of so many European countries, has resulted in what is practically abandonment of the French and British Motor Car Shows. As a result, additional attention will center about the forthcoming American displays which will be held in New York and Chicago as usual.

The Eight-Cylinder Car is Coming.—Lending point to the statement in the editorial in SCIENTIFIC AMERICAN for September 5th, that we may in the near future contemplate a wave of eight-cylinder popularity, there already has appeared the announcement of another maker who will bring out an eight-cylinder model this fall. This is the second who has looked with favor on the eight with never a glance at the six. Neither maker had heretofore produced any but four-cylinder models.

Wanted: A Good Metering Cap.—As simple as it may seem, it yet appears difficult for makers to produce a really good head covering for motoring. The usual peaked cap appears most popular, but is apt to blow off unless the peak is reversed, which gives the wearer too much of a "speedy" appearance. The ideal hat must fit the following specifications: It must be presentable; it must provide protection from dust; it should be washable and waterproof; it should incorporate goggles which, when not in use, can be made invisible, but which must be instantly available; it must not blow off; it should be light and warm; it should have a peak to protect the wearer's eyes from the sun.

The Sentiment for Right Drive.—Although the past year has seen virtually every automobile manufacturer change over from the right side for the steering wheel to the left side, not everyone views left side steering with favor. In fact, slight sentiment against left steering of late appears to be developing upon the ground that those who steer from that side incline to "hog" the road and so lay not only themselves but others as well open to the danger of accidental collision with other cars. Those who operate left side driven cars appear to dislike to drive as far to the right side of the road as it would seem necessary to do for safety. In other words, they prefer to drive nearer to the center of the road in order that they may have a better view of the right side ditch.

Car Census Shows Nearly Two Million.—According to the latest census figures covering automobile registration in the various states, there are now 1,735,369 automobiles in use in the United States. There has been a steady gain since the first of the year. These figures are both for gasoline and electric pleasure and freight vehicles. On January 1st, 1914, there were 1,253,875 cars in use. By the latest census, New York is far in the lead with 160,475 cars registered. Illinois is next with 126,681 and there are only four other states in which the figure runs 100,000 or over. These are Pennsylvania, Ohio, California and Iowa, in that order. The State of Nevada has the fewest cars, the registration showing but 1,523 in use.

Foreign Cars Now Sold Fully Equipped.—Although it has been the custom abroad for a number of years for car manufacturers to sell their product virtually "bare," of late there is a very noticeable tendency for these same makers to sell their cars, as the British say, "all on." This means, briefly, that instead of purchasing the car and afterward shopping around for horn, windshield, top, lamps, demountable rims, number plates, and, in fact, about everything of the kind that is a real necessity, the car is purchased with all those things properly fitted in place. Not more than three years ago it was the exception for a purchaser to get a car fully equipped from the maker; now it is the rule. Obviously, the various accessories are more suited to the vehicle when fitted by the car maker, who thus is assured of their adaptability. It is stated that the present war has had a notable effect in this respect, for it has given engineers more time to devote to details because of the slacking off in demand. Parts which might have served quite well for another season, it is pointed out, have been redesigned and improved, an improvement which might not have been made for another year.

Inventions

Novel Amusement Apparatus.—Frederick J. Gibson of Oakland, Cal., has patented, No. 1,107,287, an apparatus in the form of a merry-go-round in which the cars are like aeroplanes and a motion is produced simulating that of such machines, so the users will in a measure experience the sensations of an aeroplane ride.

An Apple Grader Adjustable to Different Sizes.—James R. Nunamaker of Hood River, Oregon, has secured patent No. 1,109,866 for a machine for mechanically grading apples or the like. The grading devices proper are adjustably supported so that they may be set to effect any particular grading desired.

A New Type of Telephone Holder.—A telephone arm of telescope construction has been invented. In construction it consists of three octagon shaped tubes, one fitting within the other, in such a manner that when the telephone is clamped to the holder at the outer end and the socket attached firmly to desk or partition, the arm can be extended some 30 inches and pushed back, or telescoped, to 10 inches, thus making a very neat and compact holder.

Smoothing the Edges of Collars.—It is well known that the modern mechanical laundry methods are very hard upon linen, and collars or cuffs soon have a rough edge which irritates the skin, even though scarcely visible to the eye. To avoid this it suffices to run over the edge a small rod having a suitable groove near one end, so as to flatten down the rough edge. A neat Paris device embodies this idea and also another useful one, for the pointed end of the rod serves as a buttonhole opener.

A Parachute Patent to Emile Berliner.—Emile Berliner, the well-known Washington inventor, has secured patent No. 1,110,180 for a parachute designed especially for use in connection with helicopters and so shaped as to secure a maximum retarding force for a given area of surface without disturbing or destroying the equilibrium of the parachute which is shown as shaped like a Japanese parasol with the edges curved upwardly in such manner as to form a circumferential trough which causes a partial vacuum at the outer edge of the parachute during its descent.

Traveler's Smoothing Iron.—A somewhat unusual but what appears to be a really practical device is of recent Paris invention, this being a traveler's smoothing iron, self-contained with its alcohol heater. Ladies will appreciate the convenience which is afforded by having an iron ready at hand, for on arriving at the hotel, clothes in trunks or valises are often sadly rumpled. It is then an advantage to have at hand the means of repairing the damage in a very short time, and in the neat leather case only 5 by 3 inches are lodged the iron and its alcohol lamp, the latter having a good sized asbestos burner.

Twenty-Four-Hour Clock Dials.—Now that 24-hour time is officially adopted in France, inventors have been at work upon a double-figure dial. One method is to use red figures underneath the ordinary figures, that is, 13 would come under 1 o'clock, and so on. An ingenious idea has, however, been found for watch dials, and a complete watch is now on the market which contains this makeup. The dial face has a set of 12 holes instead of the usual figures, and back of this is a rotating enameled disk with the Roman numerals from 1 to 12, and just beside them Arabic numerals from 12 to 24. First the Roman numerals appear in sight under the holes, then by pressing a button which lies above the winding stem the disk shifts around slightly so as to bring the other set of numbers into place.

Tapping Champagne Bottles.—Devices have already been invented for plugging into the corks of champagne bottles and the like so as to deal out the fluid in small quantities through the inserted tube. A new French device of simple construction has the general shape of a corkscrew, and is run through the stopper by a small screw placed on the end of the long tube. Small holes just above the screw admit the liquid to the top. At the upper end of the tube near the handle is a second screw thread which engages in the cork and makes a tight joint to prevent escape of gas. To deliver the liquid, the bottle is tilted flat so that the corkscrew handle is vertical, and by pushing a spring plug in the top end of the handle, the liquid flows out through the other end into the glass, the corkscrew handle being made hollow for the purpose.

Rubber Stopper Device.—We remark what appears to be one of the best devices for stopping bottles for travelers' use. It is made in Paris, and consists of a solid rubber cork having a prolongation at the top in the shape of a rubber tube portion of about the same length as the cork itself and of slightly larger diameter so as to come near the size of the bottle flange. Fitting in the stopper, the flexible upper or projecting part is then turned down all around so as to fit tight upon the bottle head and surround it for half an inch below the top. The whole then resembles what would be given by a cork and a metal bottle cap of the usual kind, but the use of rubber makes a flexible protector. Of course stopper and flexible part are all one piece of rubber.



Front interior view, with apparatus by which a loud click supplements the red spot.

Cards in various measures for musical performance—2/4, 5/4, 6/8, 4/4, 3/4, and 2/4—ready for insertion in the rythmikon.

The 3/4 card inserted in instrument, with the red spot appearing in the first hole at left.

The Rythmikon—a New Aid to the Study of Musical Rhythm

By Harry Chapin Plummer

YOU have listened to the "song of the wheels," that unendenced monotone so familiar to the railroad man and the traveler; you have sunk into the unconscious state and have been alive only to that "click click" and unending pound of steel upon steel. And, it may be, in such a moment you have thought of music, and some favorite song has stolen upon your senses, and, catching the perfect rhythm of those revolving wheels, has poured forth before your startled mental vision a very pean of melody.

A young English violinist, of the name of Bonarios Grimson, on his railway journeys, repeatedly experienced this sensation. Dozing in his compartment, he would be struck with that rhythmic monotone of wheels and rails. No sooner would the train settle down to a long stretch of level road than snatches of some of the great epics of violin literature would come to him, hazily, dreamily, then with sudden definiteness of lyric outline.

So, while he traveled, young Grimson thought, and his impressions took the form of a single idea. Like all musicians, he had long been conscious of the vexatious problems that arise in determining certain rhythms. The metronome, that mercilessly faithful little instrument which practising pupils had ticking on the key-block of a pianoforte, supplied but a clock-like beat of 1-2-3-4, scarcely an improvement upon the pendulum of old, which musicians of the seventeenth and eighteenth centuries employed.

"In listening to revolving wheels," Grimson declared recently, "I was impressed by the inevitable regularity of the motion, and the thought struck me that in playing music, if one could only break up this regular, circular rotation into certain combinations of beats, the problem of rhythm could be solved for once." Gradually he experimented with wheels until he had perfected a device which he styled a Rythmikon. By means of this apparatus the exact rhythm that is wanted by the musician will be ticked, merely by the insertion in a slide of a key supplying the particular meter of music called for.

The Rythmikon is based on the theory that a revolving wheel, marked at one point of its circumference, almost insensibly impresses upon the mind the steadiness—the inevitableness—of its rotation, and that the mind is commanded by the eye to observe the mark upon the wheel as it appears at every revolution. Look away from the wheel for a little while, and you will know just when to look back to catch the mark as it appears. Thus is the sense of time born—the mental division of abstract time into equal periods.

The Rythmikon consists of a revolving hand bearing a large red spot, in front of which are placed cards bearing any desired rhythm, printed as it would appear in written music, and then enlarged and properly spaced along a circular path. Corresponding with each written note is an opening in the card through which the red spot on the revolving hand becomes visible at the moment when the note is due to be played. A loud click further calls attention to its appearance. The completion of each revolution—i. e., every measure—is announced by a bell-stroke. Thirty-two rhythms are an appendage of each instrument, for purposes of study. Afterward the use of three metal plates commences.

One of these has 16 openings, the next 18, and the third 24, and virtually every known musical rhythm can be produced with one or another of the plates, which is inserted in the Rythmikon in the usual manner. When all the openings are closed there is no sound audible but that of the bell, but as the openings are uncovered the red spot appears, and at the same time a "click" is heard. These three plates are the final means of cultivating the sense of musical rhythm to the nearest approach to absolute perfection.

The speed at which the instrument may be operated can be altered at will by a simple adjustment of the knob at the back of the case, and the speed-rate will then be recorded upon the indicator at the side.

It is not intended that the Rythmikon shall be used while playing a musical instrument or in any way but as a separate and auxiliary study, which is designed to render outside assistance needless.

The speed-indicator is marked in revolutions per minute, for the reason that the Rythmikon is based on the initial idea for measures and not for beats, the beat being regarded as important only in its relation to the whole measure. If a card in 3/4 time is inserted, and it is desired to run it at a metronomic speed of 102, it is obvious that the speed-indicator must be set at 34, which will give a beat-speed of 102. Should the card be in 6/8 time, the speed-indicator must be set at 17, and so on. This feature alone has a very definite educational value in arriving at complete independence of all mechanical aids.

It is not intended so much that the machine be operated simultaneously with the performing of music, but that the player or singer listen to the rhythmic beat before performing a tricky piece of music. He may listen for a few moments; soon the rhythm will have made a definite impression on his consciousness, and the actual performance will follow without the mechanical effort that otherwise would be needed.

Let us suppose that the student is attempting to master a composition in which the time is syncopated in a manner that defies virtually the beating of time. With the aid of the Rythmikon it is necessary only to analyze the distribution of beats in a series of bars and adjust the machine to it. Then the student sets the machine going, with the result that the peculiar distribution of beats is recorded with mechanical accuracy. The subconscious mind quickly comprehends the peculiar rhythm, and the problem is negotiated without difficulty.

Ultra-violet Rays for Water Purification in Army Service

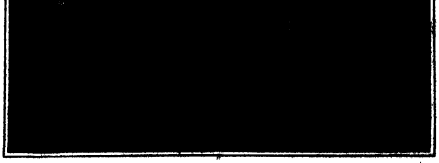
THE present war disaster in Europe makes it interesting for one to review some of the methods used for protecting the soldiers in the field against the dangers of infection from impure water; for it is recognized that maladies such as typhoid, cholera, and dysentery are propagated by the drinking water, and are far more dangerous to the soldiers than the bullets of the enemy. It is for these reasons that modern armies now employ water purifying apparatus.

Several methods have been applied for freeing the water of dangerous bacteria. One of these is that of filtration, which is effective in clearing the water, but cannot be depended upon safely to eliminate bacterial life. The results of such filtering plants used during the French Morocco campaign and the German colonial war seem to have been unsatisfactory.

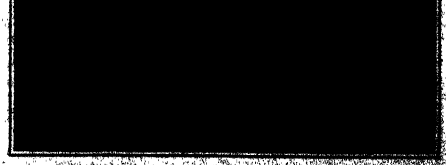
Another method is that of heating the water. Apparatus of this kind have been used in the field, but have proven objectionable as they not only raise the temperature, but produce a water which is far from palatable, by removing all the beneficial salts and gases. Chemical treatment presents so many difficulties, and the results are so unsatisfactory, that it is scarcely worth mentioning in this connection.

A device of unusual interest is an arrangement for the application of the ultra-violet rays, the germ killing properties of which make possible a field sterilizer, which can pick up polluted water and produce therefrom sound drinking water and even water for surgical use. The apparatus for this purpose consists of a white enamel tank, in which the water is made to flow near a strong source of ultra-violet radiation, this source being a mercury vapor lamp made of quartz glass. A number of baffle plates are so arranged that the water is agitated and made to pass several times under the influence of the ultra-violet rays. Both the French and Austrian armies now have devices of this kind for sterilizing the water in the field. It was first introduced by the French army in the Morocco campaign, camels being used to carry the apparatus and all the accessories for using it. Surgeon Major Tanton,

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The ultra-violet ray apparatus supplying sterilized water.



Austrian artillery car fitted with ultra-violet ray sterilizer.



Date, 1913. Tonnage, 23,000. Speed, 21.5 knots. Side armor, 12-inch, 9-inch, and 7-inch Guns: Ten 13.5-inch, sixteen 4-inch Torpedo tubes, three 21 inch

The British dreadnought "Audacious."

The Loss of the "Audacious"

Mines, Laid on the Trade Routes, Sink a British Dreadnought

A FEW weeks ago, and fully two weeks before the loss became known to the public, the British dreadnought "Audacious," one of the four ships of the "King George V." class, struck a mine off the north coast of Ireland, and went to the bottom.

This disaster came as a sequel to the warning cabled over at about the time when the loss occurred, that the northerly coast of Ireland had been mined, and shipping, using this trade route, should keep outside of certain specified waters.

That the "Audacious" was sunk by a mine, and not by a submarine, is suggested by the announcement, recently made by Premier Asquith in the House of Commons, that the British government had decided to declare the whole of the North Sea to be in the military area. In this connection he said: "In the last week of October the Germans succeeded in laying a mine field off the north coast of Ireland, on the main trade route from America to Liverpool and the ports of Scotland. Merchant ships were known to [illegible] and [illegible] the [illegible] mines, [illegible] suspected to [illegible]



Boat from, taken from the deck of the "Olympic," shows her boats assisting in the rescue of the crew.

Sinking of the "Audacious" by a mine off the north coast of Ireland.

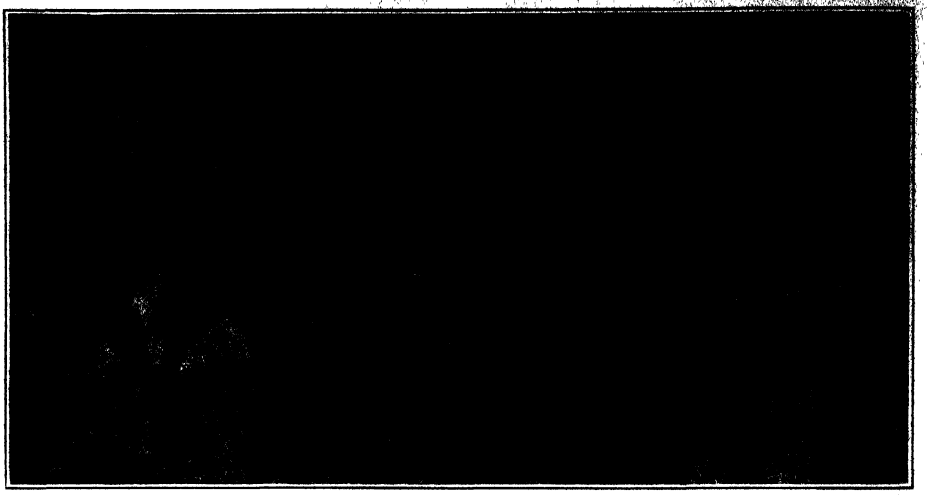
these wholly illegal methods of waging war is so great that the government has been compelled to adopt the only possible means of protection, namely, to declare the whole North Sea a military area, and to restrict all shipping crossing it to a narrow passage, along which the strictest supervision can be maintained."

The sinking of the "Audacious" is by far the most serious loss yet sustained by any of the naval powers engaged—in fact, in its bearing upon the actual fighting strength of the British navy it is equal to the sum of all the losses previously suffered. For the "Audacious" was a capital or first-line ship, one of those major units which must line up against the enemy in that supreme and decisive engagement (if it ever takes place) when the German battleship fleet emerges to fight it out to a finish in a great fleet action. The crew were saved; but this noble ship, representing a cost of from $12,000,000 to $13,000,000, is a total loss.

And yet, so vast is the British navy, and so great is its ship-building capacity, that in spite of the loss of the "Audacious," the dreadnought fleet still numbers 30 ships, and by the first of next month will number 32 ships, the 23,000-ton, 21½-knot "Audacious" being replaced by the 27,500-ton, 25-knot "Queen Elizabeth" and "Warspite." These are ships of vastly greater power, mounting the new 15-inch gun in place of the 13.5-inch gun carried by the "Audacious." Moreover, by the first of March, three additional ships of the "Queen Elizabeth" class will be completed, thus raising the total dreadnought strength of the British to 35 ships, as against 31 at the opening of the war.

We have already stated in these columns that, because of

(Concluded on page 445)



The mobile French infantry.

French machine gun section advancing against German position between Mondidier and Roye. The machine gun in this war has played an important part; it is so mobile. Each man carries a part, and it can be ready for firing at a moment's notice.

Strategic Moves of the War

Letter from the Military Correspondent of the Scientific American, November 21st, 1914

The French Campaign.

THE battle line in France and Belgium has presented an unusual instance of the opposing forces on both sides acting on the defensive. The Allies are well content with this rôle because they feel that time will improve their chances through enabling them to better equip their troops, especially in regard to heavy artillery. The Germans have adopted the defensive temporarily in this field in order to enable them to throw greater strength into the campaign against Russia.

This does not mean that the armies rest idle, fighting only when attacked. It means that no general aggressive move is attempted involving one or more of the armies into which the fighting forces are divided. Each organization must, however, keep in close touch with the enemy in its immediate front. By aerial reconnaissances and by assaults of small columns they keep track of the enemy's movements. If a weak point is developed anywhere, more troops are rushed in and in some cases the enemy's trenches are captured. In the fighting in France during the last three weeks the various successes reported have been such minor gains. The enemy falls back a few hundred yards, entrenches again, and the contest is renewed.

The most active operations have been in Belgium. The opening of the dikes along the Yser Canal both north and south of Dixmude has flooded a fifteen-mile stretch sufficiently to prevent the advance of large bodies of troops. Consequently, the center of fighting has moved southward to the vicinity of Ypres.

Here the Germans have made a determined effort to break down the opposition of the British troops. During the first days of this month the German assaults were made in great strength by the reserve troops that had just reached the front after service in the capture of Antwerp. The British were driven back five miles from Roulers to Ypres and Bixschoote, but succeeded in stopping the attacks.

After a period to recoup their losses, the Germans again launched their assaulting columns against the British position at Ypres on November 10th, 11th, and 12th. The importance that they ascribed to success in this field is shown by the presence of the British Guard Corps in the attacking force. This elite organization is composed of the best blood of the empire and is given the post of honor where decisive results are expected. These assaults also were repulsed by the British, who fell back at points but regained their original line.

Similar attacks were delivered on the French at Bixschoote and on the British at Armentieres, but with like results. The object of this move was to drive back the left flank of the Allies and to capture Dunkirk. By attacking at Ypres, the Germans secured the advantage of the direct line of rail through Brussels and Liège for rushing troops and supplies to the critical point. They also had a chance to cut off and capture the Belgian army in case they should succeed in breaking through.

The German force in Belgium was weakened during the week by the dispatch of their cavalry to the Russian border. The Uhlans and dragoons were of little use in the intrenchment warfare except as an indifferent substitute for infantry. In the east, though, they were very much needed to oppose the raids of the Russian Cossacks. Consequently, the greater part of the mounted troops from France have been transferred to strengthen the latest German strategic move from Posen.

While pushing this countermove against the Russians the Germans have slackened the impetuosity of their attacks in the west. They still continue on a smaller scale, but are now made largely to screen the reduction of German strength. This campaign or battle in France has been noteworthy in the world's military history. In spite of being outnumbered five to four, the Germans have not only maintained their line for ten weeks, but have forced the fighting.

This is one of the best evidences of the unprepared state in which France and Great Britain were caught. Both countries had been making partial preparations for two years against this eventuality, but neither seems to have gaged the strength of the effort of which Germany was capable.

The great value of the Belgian resistance now shows more clearly. If it had not been for the ten-day delay in the German advance caused by Liège and Namur, the British would have been unable to join the French, and the latter could hardly have stopped short of the Loire without disaster. Certainly, if Great Britain and Belgium had not joined the Allies, the French would by now have suffered serious reverses.

The Allies in France now have abundant men and small arms. Their delay in making aggressive movements can be explained only by a weakness in artillery. These guns cannot be made in a hurry when need arises. With every resource of these two great nations, it will take them four months to turn out the first equipment of heavy mobile artillery that is needed to support attacks on intrenched positions.

In Lorraine and Alsace the French have profited by the weakness of the German armies in these regions. The French have once more forced the fighting back to and across the border. East of Nancy the French occupation of Nomeny, Champenoux, and Cirey brings them once more to the positions occupied in the second week of August. In Alsace the French hold the passes through the Vosges and have captured Thann and Altkirch, ten miles east of the border.

The Russian Campaign.

The campaign in the eastern theater of operations has developed a further Russian advance in East Prussia and Galicia and a new aggressive move by the Germans in Poland.

The campaign in East Prussia has been subordinated to that in Poland. The Russian successes here are due mainly to the transfer of German troops to other fields. Until this occurred the Russians were held fast to the line through Stallupoenen, Goldapp, Lyck, and Bialla. The importance of a continuous feeling-out of the enemy's lines by scouting and by attacks in force is shown by the promptness with which the Russians pushed the Germans back when their strength was reduced.

It is noteworthy in this campaign that the Russians are avoiding the lake region along the southern border in which their army was tangled up and beaten by Gen. von Hindenburg in September. The Russians now seem content to hold back in this region while pushing their advance in the north. Here they have succeeded in forcing the Germans back to Gumbinnen and the Augerapp River. The Germans, though, still hold their advanced position at Pilkallen. The Germans need every man possible for their campaign in Poland, so the Russians must have a large superiority of numbers in East Prussia.

If the Russians can continue their advance on Koenigsberg they will in time clear the lake country and enable their forces to move forward to a straight line running from Poland to the Baltic Sea. Their big disadvantage lies in their lack of railways. When their forces are concentrated in one district they have to stay there, while the Germans can shift their armies to make successive attacks in force at different points. The Russian advantage in numbers is thus offset by the German mobility.

In Poland the Russians have been checked before the German entrenched position between Sierads and Czenstochowa. In their retreat the Germans destroyed all railroads and bridges and left the roads well-nigh impassable to vehicles. Consequently, the Russians in their pursuit had to leave most of their artillery behind. The freezing up of the country has facilitated the operations of their troops, and the arrival of heavy guns and of new troops at the front should soon warrant a resumption of aggressive tactics by the Russians.

Meanwhile the Germans are making another strategic move similar to the one in October that drove the Russians back to the Vistula. The garrisons from the lower Vistula forts were collected at Thorn and troops were transferred from East Prussia, from Silesia, and even from Belgium, to strengthen the German efforts.

On November 12th they started their forward move

[illegible] the Russian army to the south. [illegible] was overpowered and the new [illegible] swept on to Lipno, Plock, and Kutno, half [illegible]. On November 16th the Germans had [illegible] line through Mlawa, Bilsk, Plock, Kutno, [illegible] on the Warthe, ten miles south of Kolo.

The Russian cavalry raid that penetrated to the [illegible] of Posen was quickly driven back by the Germans. Their communications were thus made secure, enabling them to maintain their position along the Warthe, from Sieradz to Czenstochowa.

In Galicia the Austrian resistance has crumpled. The main Russian campaign has been directed against Cracow and has steadily pressed the Austrians back. On November 9th the Russians had reached Pilica and Miechow, twenty miles from Cracow. By the 15th they were five miles closer, and on the 17th they were attacking the outer line of forts.

This advance placed the Austrian army in Galicia in a dangerous position. If the Russians should break through, they would cut the Austrians off from their normal line of retreat through the open country south of Cracow. A retreat through the passes of the Carpathian Alps at this season would be so difficult as to expose the rear of the columns to being cut off while delayed by the slow progress in front.

Consequently, the Austrians have abandoned central Galicia and have drawn in their armies to the west to strengthen the resistance on the Cracow line. On November 12th the Russians occupied Tarnow and Sanok, and on the 16th they had gained Jaslo and Dukla, while Cossack columns had seized the passes of the Carpathians from Dukla to Bukowina.

The advantage in the fighting in this theater lies, so far, very much with the Russians. They are confronted now with the threatening move of the Germans from Thorn. If the Germans succeed the Russians will have to give up their campaign against Posen, while the East Prussian gains will amount to little. If, however, the German move is stopped, the Russians will be free to prosecute their winning campaigns in all three localities, East Prussia, Poland, and Galicia. In any case, the Russians seem unlikely to lose their recent gains in this last district.

The Legal Definition of a Patent

By Hon. Thomas Ewing, Commissioner of Patents

IN popular language the word *patent* means the original document, or a printed copy of the illustration and description attached thereto, or the invention itself, or some particular physical embodiment thereof. What I wish to discuss is the mutual legal rights of the parties evidenced by the document constituting letters patent.

1. A patent is a contract, and just as every written memorandum of an agreement is merely an indenture witnessing the agreement, so the letters patent are merely evidence of a contract.

Under the old procedure in England, where our patent system originated, some of the patents were in the form of indentures. The patents were granted as an exercise of the prerogative of the Crown, and the Crown was at times a part owner. James I invested one hundred thousand pounds sterling in the Royal Alum Works, which operated under a patent.

In this country the right to reissue patents was introduced into our practice on the theory that the patentee was merely exercising the right of correcting a contract. This practice in the absence of any statutory provision therefor was sustained by the Supreme Court of the United States speaking through Chief Justice Marshall in the famous case of Grant v. Raymond, reported in 6 Peters.

2. The consideration for a patent is the disclosure of a new and useful invention in the specification of the patent. As Lord Eldon stated in Cartwright v. Eamer, patents are to be "considered as bargains between the inventors and the public, to be judged of on the principle of keeping good faith by making a fair disclosure of the invention."

3. Anyone having an invention to communicate may obtain a grant. So long as the matter rested in the prerogative of the Crown this was not true. The Crown might exercise its prerogative or not, as it chose. But when the prerogative of the Crown was lost, the principle that all men are equal before the law eliminated any element of favor from the granting of patents.

4. With the disappearance of the royal prerogatives, there disappeared also another conception, viz., that the right to use the invention arises out of the grant. The old English patents contained two separate clauses, one specifically granting the right to use the invention, and the other prohibiting anyone else from doing so. These grants were made at a time when it was customary for kings to grant licenses to trade. When, however, it became established that freedom of trade is the birthright of every subject or citizen and monopolies were strictly limited to new manufactures, the grant carried with it no right of use and no restriction of established trades, but merely the right to exclude others from the enjoyment of the new thing. The phrase of the granting clause of our patents, "the exclusive right to make, use, and vend the said invention," which is recited in Section 4884 of the Revised Statutes, is a heritage of the old idea that the grant conferred the right to use as well as the right to exclude others from using.

5. The patentee must be an inventor, and the patent must be granted for a limited period. This is because of the constitutional provision contained in Article 1, Section 8, which reads as follows:

"The Congress shall have power to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

Under this provision, Congress, if it undertakes to provide a patent *system*, must enact one which is primarily directed to rewarding inventors, and the only reward is to secure to them exclusive rights for limited periods. A system which is not characterised by these features is *dehors* the Constitution.

6. There is no statutory requirement that the patentee must be the first inventor. As between rival inventors the question of priority arises under Section 4904, which provides that where there are rival applicants, or an applicant for a patent to an invention already patented to another whose patent has not expired, the Office shall proceed "to determine the question of priority of invention." This phrase "priority of invention" occurs nowhere else in the statute. It is intended to cover only those cases where two parties are claiming the same thing as against the public. It is true that the applicant must swear that he believes himself to be the original and first inventor, but Section 4886 provides that any person who has invented something of patentable character may receive a patent upon due proceedings, provided that the thing was new when he invented it, and provided that he has not lost his right by delay. The language is too broad to warrant the statement that the applicant must be the original and first inventor; it is sufficient that the applicant be an independent inventor, that the original and first inventor is not contesting his right, and that knowledge of the invention was not available to the public before the applicant invented.

The legal definition, therefore, of a patent for an invention, is that it is a contract between a party claiming to be the inventor thereof and the Government, made in consideration of a disclosure of the invention by the claimant in his application, and proceedings taken as required by statute, and evidenced by letters patent conveying a grant by the Government to the inventor and his assigns, for a limited period, of the right to exclude all others from making, using, and selling the invention patented.

Motorcycles in the War

MOTORCYCLES are being found extremely useful in the war operations, especially for the transmission of dispatches, in which work they have proven superior to horse couriers. Another direction in which their utility has been found valuable is for use by the officer in charge of motor supply trains, as they enable him to keep in constant touch with the entire column. At the commencement of hostilities all of the nations involved seized all the motorcycles they could find, and since then heavy orders have been placed for more machines. Russia has recently placed orders in England for over sixteen hundred machines, distributed between six makers, all the machines that could be supplied within the specified date. This country has also made purchases in the United States, and it is reported that one manufacturer has booked an order for eight hundred machines as an instalment of a total order for twenty-five hundred; and another concern has made some large sales to Japan, and it is supposed these machines are to be passed on to Russia. Bicycles have not been overlooked, and it is said that already over two thousand have been sold to the European armies. Exact figures are not obtainable, as naturally American manufacturers are not anxious to make public their sales in these quarters.

The Current Supplement

THE current SUPPLEMENT of the SCIENTIFIC AMERICAN for November 28th, No. 2030, contains an article on the New York Fire Alarm System, by the Chief of the Bureau of Fire Alarm Telegraph, which should interest the dwellers in every city in the country, as it discloses a surprising condition of hopeless inefficiency in one of the vital branches of the machinery of a city that can easily exist almost anywhere when citizens fail to exercise proper supervision over their municipal affairs. A protective treatment of metals and an article on economical power from low grade fuels will be of great value to a host of practical people. There is also an illustrated article telling about the greatest irrigation dam in the country. Resistance to a ship's motion tells something about designing ships, and new ideas will be found in the discussion of the use of colors for signaling.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

English Armored Automobiles

To the Editor of the SCIENTIFIC AMERICAN:

In the article on "Armored Automobiles in War," published in the SCIENTIFIC AMERICAN of November 7th, my remarks on English armored cars are not correct, as in addition to Daimler trucks some touring cars have been fitted up with armor and quick-firers. The naval force sent to Antwerp included several of these.

London, England. JOHN JAY IDE.

The Muscular Machine

To the Editor of the SCIENTIFIC AMERICAN:

In Watt's method of measuring energy, he did not seem to make any distinction between energy produced by a motor and energy produced by muscular exertion, and I do not recall ever seeing in print any distinction made between them, and yet the difference can be demonstrated quite easily.

For instance: Should a motor raise 100 pounds 5 feet, we would regard it as 500 foot-pounds, even though it be raised in a second, minute, or hour; but should a 150-pound man consume one hour in raising (without apparatus) 100 pounds 5 feet in one continuous journey, he would produce only 500 foot-pounds, but completely exhaust himself, while it is quite obvious that he could, with much less exertion, walk up a hill 100 feet high in ten minutes, thereby producing 15,000 foot-pounds, or thirty times more energy than in the former case.

Again, should the man have placed in his arms 100 pounds, and attempt to hold it one hour, he would produce no work at all, but nevertheless would be required to exert great muscular energy to simply sustain the weight.

Another remarkable distinction is the fact that the animal or man consumes energy in descending a hill or stairway, while any inanimate machine gives forth energy in descending.

It would appear that the muscle, unlike any other form of motor, has a critical time to perform efficiently.

Riverton, N. J. CHARLES A. WRIGHT.

Ship Engine Control from the Bridge

To the Editor of the SCIENTIFIC AMERICAN:

In the synopsis of contents of SCIENTIFIC AMERICAN SUPPLEMENT No. 2022, published in October 3rd issue of SCIENTIFIC AMERICAN under subhead "Westinghouse Bridge Control," I note that an attempt is made by designers to control ship engines from the bridge. It is probably useless for one in my obscure position to attempt to criticise the scheme, but from my experience on and around lake and river boats, I should say that the idea is dangerous.

First, the captain or pilot as licensed by the Government is not required to know anything more about the operation of the engines than that one bell means stop; two, go astern; three, check; four, strong in direction at moment going; one also means start ahead if at rest. How to get these motions is not the thought of pilot, simply the results of said movements of propellers.

Inasmuch as the Government does not allow even the sole owner of a ship to navigate her, unless he has a license, but holds the regular pilot responsible for the safety of his ship as well as others, and stands back of him if he refuses to do the bidding of the owner, in case he sees danger in complying, how can the Government allow one licensed man to interfere with the work of another of their licensees?

There are oilers constantly passing through and around the engines when running and repairing and adjusting them when at rest, the Chadburn gong sounding in engine room gives engineer in charge notice of desires of pilot, and, if everything is clear, he complies with the order; the gong also warns others to get in the clear, and the position of throttle cut-off and reverse levers is such that the person moving same has a very clear view of moving parts and the platforms and ladders adjacent thereto.

The sudden starting or stopping of the cross-heads alone could easily mean death. How could the pilot know there was an oiler with his body foul of moving parts before he started up? What would he do if the engine took a good dose of water or lost the vacuum?

If the engineer in charge were to jump in and stop engines in such an event, might not the pilot be in a ticklish position in cramped waters and the ship, with others, endangered? This is the day of levers and push buttons, I must admit, but there is as yet great need of a mental clearing house every so often to examine the checks and see that no forgeries get in. Would suggest that this device be first tried out on a freight train, with the conductor handling the engine from the caboose. CHARLES M. GREEN.

Bedford, Ohio.

The "Foot-and-Mouth Disease"

A Scourge of Cattle Which Attacks Man

By Lewis W. Fetzer, Ph.D., M.D., of the Georgetown University Medical School

LIKE a clap of thunder and a bolt of lightning from a clear sky comes the announcement that foot-and-mouth disease is again with us. The announcement by the State Veterinarian of Illinois that the disease was prevalent among the cattle on exhibition at the National Dairy Show caused many to hold their breath and wonder what would be the fate of the valuable stock on exhibition.

This is not the first time that this pestilence has visited our shores, for we have had outbreaks from time to time, the last occurring in 1908. In 1908 and 1902 it was transmitted to us through the agency of the virus of cowpox imported from abroad and intended for the vaccination of human beings against smallpox.

The story of the 1908 outbreak is very succinctly told by the diagram taken from Circular 147 and also the 1908 Report, page 390, of the U. S. Bureau of Animal Industry. It appears at the time that the first intimation of the presence of the disease was in two carloads of cattle which were sent to Pennsylvania from the stockyards at Buffalo, N. Y. The source of the infection was finally traced to Detroit, Mich., where foot-and-mouth disease was present among twenty-one heifers previously used for the preparation of anti-smallpox vaccine. The outbreak of 1902 started in Chelsea, Mass., and is thought to have originated on the farm of a man who had a contract with a vaccine company to rent calves for the growing of cowpox virus. Later independent outbreaks were noted in other parts of Massachusetts.

The present outbreak is said to have its origin in Michigan and Indiana, and on October 19th the Secretary of Agriculture issued the Bureau of Animal Industry Order No. 220, which has the effect of preventing the shipment of cattle and their products out of these States. This order has been amended several times, and the quarantine at this writing includes the States of Michigan, Indiana, New York, Maryland, Illinois, Wisconsin, Iowa, Pennsylvania, Ohio, Massachusetts, Connecticut, Rhode Island, Delaware, New Jersey, Montana, and Kentucky.

This disease, known by various names, as aphthæ epizootica, eczema, epizootica, infectious aphtha, aphthous fever, Maul und Klauen Seuche (German), fièvre aphtheuse (French), etc., has been known from time immemorial and in many parts of the globe. The worst outbreaks have been in Europe, some of them in recent years.

Although attacking cattle principally, it affects hogs, goats and sheep, and next in order of susceptibility come the buffalo, American bison, camel, deer, chamois, llama, giraffe, and antelope. Young dogs and cats are especially susceptible to the infection, while guinea pigs and rabbits take the disease only exceptionally. Mice and poultry and older carnivorous animals are apparently immune. The horse and man sometimes become infected with it.

Foot-and-mouth disease is a very contagious and infectious malady which runs through an acute course and has as its essential feature the formation of blisters—vesicles, as they are called by the medical man—on the mucous membranes of the mouth and upon the skin between the toes (of cloven-footed animals) and around the coronets of the feet. Although these are the localities usually attacked, there may be other involvements, such as in the intestines and on the udder. The disease is most often ushered in with a chill which is followed by a fever. The fever, which may go as high as 106 deg. Fahr., subsides somewhat when the blisters make their appearance, which is usually in one or two days. The blisters, which contain a thin, yellow, highly contagious fluid, are at first the size of a hemp seed or pea, but they finally enlarge and often reach a silver dollar size. On maturity the blisters burst, discharge their fluid, and leave eroded raw surfaces which do not easily heal. In the course of the disease the animals lose their appetite, become very weak, and, in milch cows, the milk yield is seriously affected. The milk from these animals, especially those in advanced stages of the disease, becomes thin and often shows deposits of curd or a sediment composed of decomposition products and blood fibrin. The animals so affected cannot chew their food on account of the swollen condition of the lips and mouths. Veterinarians can easily detect animals affected with the disease by the smacking sound which they make with the lips and the ropy or stringy saliva which hangs from the mouth. Such animals when given water seek relief from the pain by playing around in the bucket with their snouts. The mucous membrane of the inner part of the lips and the gums of the teeth feel warm to the touch, and upon opening the mouths of these animals they show the characteristic blisters.

As a rule, all four feet of an animal are attacked, but it occasionally happens that only a part of them become diseased. The malady lasts for about ten to twenty days, but one attack of the disease does not always spare the animal from another. As mentioned above, the contagious agent is contained in the fluid of the blisters. This fluid when discharged in sneezing contains fine solid particles in suspension. Despite the fact that the disease has been known for a long time, very little is known about the exact nature of the infectious agent. To be sure, several investigators have come forward at various times and claimed that this or that microorganism which they had isolated was the cause of the disease.

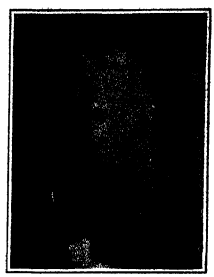
A similar history has yellow fever and hog cholera, but in none of these has the cause been shown by way of the microscope or cultivation on artificial media. The micro-organism, or what not, causing foot-and-mouth disease is so evasive that it passes through the finest pores of a porcelain or biscuit filter which under ordinary conditions will filter out or retain such germs as the tubercle or typhoid bacillus. Consequently we must regard the cause as an ultra-visible and ultra-filterable virus which exists both in the lymph and blood.

It must be said, however, that the subject has been in controversy during the last three years, for it was Siegel, a German scientist, who presented evidence that the disease might be caused by globoid bodies—cytorrhyctes cocci—which often show an arrangement similar to the organism causing gonorrhœa or spinal meningitis. These data were the subject of study by a commission appointed by the German government, but the results obtained in the laboratories of the Imperial Health Department at Berlin did not support Siegel's findings.

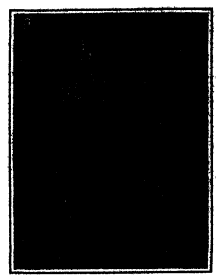
Like any other disease, this scourge may be transmitted by many avenues. If we stop to consider that 1/5,000 of a cubic centimeter of the lymph—blister or vesicle fluid—injected into a vein is sufficient to cause the disease, we can gain an idea as to the virulence of the same. Notwithstanding the high degree of virulence of this germ, it, like the tubercle bacillus, loses its potency when subjected to drying at ordinary temperatures and sunlight (within twenty-four hours). Strangely, when diluted 1:10 and kept in sealed tubes it retains its virulence for three to four months. When exposed to a temperature of 70 deg. Cent. (158 deg. Fahr.) for ten minutes, or heated to 100 deg. Cent. (212 deg. Fahr.), it is robbed of its infecting qualities. Repeated exposures to low temperatures, as —8 to —9 deg. Cent. (15.8 to 17.6 + deg. Fahr.), also destroys its virulence. It may also be destroyed by the well-known antiseptics, as carbolic acid, formaldehyde, hydrochloric acid, and soda solutions.

When the disease is present among animals kept in the same barn, field, or corral of the stock market, it is transmitted by contact with the saliva, vesicular fluid, or feces. Indirectly it is carried in the drinking water in troughs where diseased animals have drunk, in feed (hay, etc.), bedding, on the stall floor, animal transportation cars and boats, and in the pasture. Dogs, cats, fowl, and other birds are also dangerous mechanical carriers of the disease, and persons harboring these in regions where the disease is prevalent should make an effort to keep them confined until all danger is past. One of the greatest sources of danger in transmission is on the boots, shoes, clothing, and hands of persons who go from an infected barn to others where the disease does not exist. To prevent transmission through the agency of man, the officials of the U. S. Bureau of Animal Industry are provided with rubber coats, boots, hats and gloves, which may be easily disinfected before leaving an infected establishment.

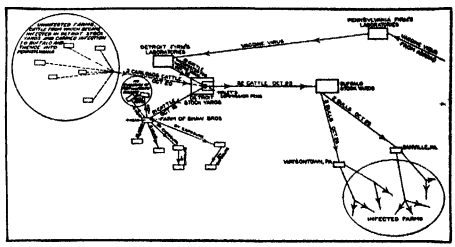
Man may also become a victim of the disease. While this danger is more remote than it has been in years



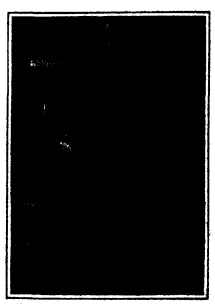
Head of an infected cow.



Lesions on a diseased cow's foot.

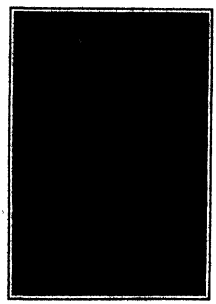


How the foot-and-mouth disease was spread in 1908.



Photographs from the Bureau of Animal Industry

Inspector attired to prevent carrying contagion.



Method of disinfecting inspector with formalin gas.

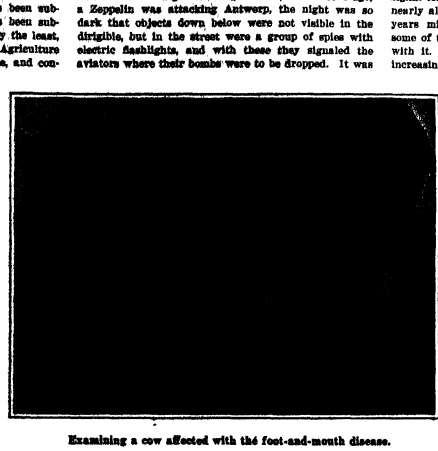
...ing front and the division headquarters. The cavalry, compelled to move rapidly, have radio pack sets which are equally effective.

The use of various forms of light for signaling is rapidly extending. Aeroplanes are now fighting with light signal apparatus, which greatly increases their effectiveness in night scouting. When, some weeks ago, a Zeppelin was attacking Antwerp, the night was so dark that objects down below were not visible in the dirigible, but in the street were a group of spies with electric flashlights, and with these they signaled the aviators where their bombs were to be dropped. It was not long before the Belgians realized the trick and shot the spies, but in the meantime the bombs had done their work.

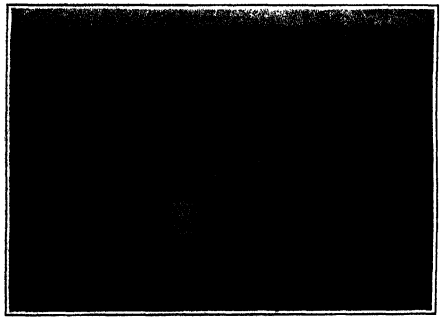
Another method of signaling now extensively used both for naval and military purposes is the searchlight, which is also invaluable for detecting hostile tricks at night. Its messages are sent by a flash code, the beam being raised or lowered or moving to the right or left, projected into the clear air or on a cloud, as the case may be. It is also an effective means of communication between an army or a fleet or a belligerent garrison.

In view of the prominence which the submarine has recently assumed, the new Fessenden submarine signaling device described a few weeks ago in the SCIENTIFIC AMERICAN is attracting much attention. It consists of an electric oscillator, which when attached to the inner skin of a ship sends out a tone that can be heard on board another vessel five to thirty miles away. This signal tells of approaching ships or icebergs. By its use nearly all the terrible marine disasters of the past two years might have been averted. It is believed that some of the European submarines are already equipped with it. Inventors are hard at work on methods of increasing the efficiency of the submarine. A leading American constructor is said to have turned over to the Germans a device by which a submarine can run along the enemy's coast and send out devices to cut the cables of the mines guarding the naval bases, pass into those bases submerged, and torpedo the hostile warcraft at anchor within harbors where it was supposed to be safe, behind mine fields and fortifications. When it is remembered that the submarine can now carry enough fuel to travel more than 450 miles on the surface, and when operating submerged at a speed of 5 knots, can cover fully a hundred miles, the rapidly augmented importance which recently attaches to its war operations is easily understood

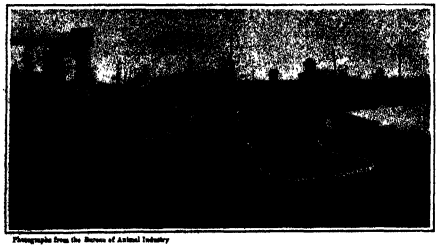
As indicating the immense value of electricity on board battleships, in a recent installation there were 3,000 electric lamps, motors having an aggregate rating of 4,000 horse-power, and approximately 76 miles of cable. By electricity the captain transmits his orders as to the speed of the propellers, the position of the rudder, the course of the vessel, and the range of the enemy, as well as his instructions as to the handling of the guns Each turret and group of guns has its own local system of interior communication, electrical or mechanical. The ship's dynamos, steam driven, are the primary source of electric power, though storage and other batteries are used to a limited extent. A special problem on board ship is the illumination of the cross-wires of telescopic gunsights, to enable the gun pointers to aim at night. This is done by the diffused light from the searchlight used to illuminate the target. In cases where this is not practicable, miniature lamps are kept ready for night sighting. There are also special problems in telephony to be dealt with. One of these is the providing of a transmitter which will operate in any position, which the ordinary carbon transmitter will not do Loud speaking telephones or megaphones are used for "paging," for calling away boats, and transmitting information of various kinds The bugler blows into the megaphone transmitter the call for any particular boat, or the messenger calls for the electrician in charge of a special department, and thus saves the endless and wearisome climbing of ladders which was formerly involved



Examining a cow affected with the foot-and-mouth disease.



The slaughtered animals are buried under at least five feet of earth.



Photographs from the Bureau of Animal Industry

Disinfecting with a 5 per cent chlorinated lime solution.

Frederick L. Goss Dies

FREDERICK LLEWELLYN GOSS, one of the inventors of the well-known printing presses that bear his name, died at his home in Chicago on November 10th, at the age of sixty-seven years. Mr. Goss was of English parentage, but was born in Wales. Coming to this country when quite young, he entered the printing business of the J. M. W. Jones Company in Chicago, where he soon reached the position of superintendent, acquiring, in the meantime, a thorough knowledge of the business. With his brother Samuel he invented the press that has carried his name into many of the largest newspaper plants in the country, and they formed the Goss Printing Press Company, of which he was long vice-president.

An Unfailing Reminder.—Among useful inventions which are brought out by a Paris firm is noted a handy little device in the way of a memorandum tablet which serves as a reminder of engagements or the like. It consists of a small celluloid tag which has a spring clip to attach it to a watch. The tag is fastened to the watch stem in such a way that it covers the face of the watch and thus cannot fail to be seen by the wearer. The pencil notes can be readily effaced.

Electricity in War

THE extent to which electricity has come to play a vitally engrossing part in modern warfare is yet but little realized outside of engineering circles. One of the most notable features of the conflict now being waged in Europe is the way in which information as to the movements of the contending armies has been transmitted. The leading factor in this important branch of military operation has been, of course, the aeroplane, which has done scouting and reconnaissance work besides fighting aerial duels on its own account, or patrolling nightly the air over where the Kaiser is sleeping, to guard against the bomb-throwing aircraft of the enemy. Supplementing the operations of these machines is the work of the [illegible] service, which by means of a remarkable [illegible] which slips into the pocket or can be [illegible] the shoulder, can instantly establish telephonic or telegraphic communication between the fighting

The Heavens in December

The Heat We Receive from the Stars

By Henry Norris Russell, Ph.D.

IT has long been a question of much interest whether we receive heat from the stars, and, if so, how much. The first half of the query was answered in the affirmative, from the theoretical standpoint, long ago. The stars send us light, of the same nature as that which we receive from the Sun; the Sun's light carries energy with it, which appears as heat in the bodies upon which its rays fall; and hence a certain amount of energy must be brought us from the stars, and their radiation must have a heating effect, though an excessively small one. Even for the brightest of all stars, this should, however, be not more than one ten-thousand-millionth of the heating effect of direct sunlight, or about a hundred-thousandth part of that of the light of the full Moon. It is not surprising, therefore, that until recent years all attempts to detect and measure these almost infinitesimal amounts of energy met with no success.

About fourteen years ago Prof. Nichols, working with the two-foot reflector of the Yerkes Observatory, secured the first unquestionable direct evidence of heat-radiation from the stars; but, even with the most sensitive detecting apparatus that could be devised, it was only possible to make observations on a few of the very brightest stars. He found, however, that stars which look equally bright to the eye may send us different amounts of radiant energy, for Arcturus, which looks to the eye very nearly equal in brightness to Vega, produced more than twice as great a deflection as Vega upon the scale of his apparatus.

No very great advance was made in this very difficult field until the present year, when Dr Coblentz, of the Bureau of Standards in Washington, reported upon his summer's work at the Lick Observatory, whither he had gone to attack this very problem. How great a stride forward his work represents can be seen at once when it is realized that his apparatus will give distinct indications of the heat received from stars so faint as to be invisible to the naked eye. It is perhaps a hundred times as sensitive as some of the earlier ones.

To have any chance of success it is, of course, necessary to concentrate the light of the stars as strongly as possible, by means of a large telescope, and a reflecting telescope must be used, for the glass of a lens, though transparent to ordinary light, cuts off a great part of the radiations of longer wave-length which carry much of the energy.

Dr Coblentz had the good fortune to have the 36-inch Crossley reflector put at his disposal; but, even with this powerful instrument, his success is mainly due to the very delicate heat-measuring apparatus which he devised.

Like a number of other appliances with which brilliant advances in observational work have recently been made, this is essentially very simple, being a "thermo-element" composed of fine wires of bismuth and platinum, joined at the tip, which is expanded into a little disk 1/60 of an inch in diameter, and blackened to make it a good absorber of heat. When the star's rays fall upon this junction of the two wires it is very slightly heated, and this sets up a thermo-electric current in a circuit of which the wires form a part, and causes a deflection of a sensitive galvanometer.

To protect the thermo-element against changes of temperature and other disturbances, it was hermetically sealed in a glass receptacle which was exhausted to a very high vacuum. A window for the admission of the light of the stars, cemented upon one side of this receptacle, was made of fluorite, the most transparent material for the long heat-waves.

Using a galvanometer of the sensitiveness "usually employed at the Bureau of Standards" (in such delicate work) it was possible to obtain the amazing results already briefly described.

The radiation from more than a hundred celestial objects was measured, and the results, themselves of the highest interest, open up an entire new field of investigation.

The most important feature of the observations was the comparison of pairs of stars of about the same brightness to the eye, but differing in color and spectral class, and close together in the sky, so that the influence of the absorption of their radiation in our atmosphere was the same. It was invariably found that for the same visual brightness, a yellow star sends us more heat than a white one, and a red star more than a yellow. Speaking roughly, Dr. Coblentz declares a yellow star of spectrum like the Sun gives out twice as much energy or "heat" in proportion to its light as does a white star like Vega or Spica; while a red star like Antares radiates three times as much heat as a white one of the same apparent brightness.

Certain exceedingly red stars—notably the star 19 Piscium, which is typical of a peculiar class whose spectra are denoted at Harvard by the letter *N*—give out twice as much heat in proportion to their light as the ordinary red stars do.

It may be surprising at first sight to read that these facts strongly confirm the accepted theory that the whitest stars are the hottest and the reddest the coolest; but a little consideration will show that this is really so, and that the hottest stars will give out the least heat in proportion to their light, or, reversing the proposition, the most light for a given radiation of heat. If we heat a body to a temperature a little below 500 deg. Cent. (or 900 deg. Fahr.) it will be just short of a "visible red heat"; that is, while freely radiating energy at a considerable rate, as we may assure ourselves by bringing our hands near it, it sends out no light at all.



At 11 o'clock Dec 7.
At 10½ o'clock Dec. 15.
At 10 o'clock Dec 23.
At 9½ o'clock : Dec. 30.
At 9 o'clock : Jan. 7.
At 8½ o'clock : Jan. 14.
At 8 o'clock : Jan. 22.

NIGHT SKY: DECEMBER AND JANUARY

Heat it a little hotter, and it begins to glow with a faint red light, but it light-emission, in proportion to its heat, is very small. As its temperature rises, it will steadily emit more light and more heat; but the increase of luminosity will far outrun that of heat radiation, so that its "luminous efficiency," from the engineering standpoint, will rapidly increase. At the same time the proportion of light of the shorter wave-lengths —green, blue, and violet—in its visible radiation will increase, giving rise to the familiar change in color from red through yellow to white.

A practical illustration of these principles is the well-known efficiency of the tungsten lamp, which, for the same consumption of electrical energy (and hence, radiation of heat) gives some three times as much light as an old-fashioned carbon lamp. This is explained entirely by the fact that the working temperature of the tungsten filament is several hundred degrees higher than that of the carbon.

It is well known to illuminating engineers that even the highest temperatures which known materials will endure without volatilizing fall far short of those at which the luminous efficiency would be the greatest.

The stars begin about where terrestrial light-sources leave off. The very red stars of spectrum *N* are not improbably cooler (on their surfaces) than the tungsten filament. Such stars as Antares are probably a little hotter than the safe working temperature of a tungsten lamp; and so the scale of temperature rises past that of the Sun, to the white stars, and the luminous efficiency rises with it, just as Dr. Coblentz has found.

He has added a direct proof of this in a simple and elegant way, by interposing, at times, in front of his apparatus a cell containing a layer of water one centimeter thick. This water, though transparent for all the visible rays, is opaque to all those whose wave-lengths are twice as long as that of red light, and hence, to the greater part of the "obscure heat" radiated by bodies at moderate incandescence.

Tests on various stars showed that the water cell absorbed about 35 per cent of the radiation from white stars, such as Vega and Altair: 50 per cent of that from stars of the solar type, like Capella, and 75 per cent of that from red stars like Antares. This is as convincing a proof as could be wished that the reddest stars have the lowest temperature.

The possibilities of future observation opened by Dr. Coblentz's work are almost unlimited. The investigations so far made were only preliminary, and no attempt was made to push the sensitiveness of the galvanometer to the highest attainable limit. If this was done, and if the apparatus could be attached to the 100-inch telescope at Mount Wilson when this is completed, a sensitiveness probably twenty, or even fifty, times greater than the present could be attained, and it would be possible not only to measure the energy radiated from stars of the ninth or tenth magnitude, but to analyse the radiation of the brighter stars, and find its exact distribution among the various wave-lengths.

It would then be possible to estimate their temperatures with considerable accuracy, as can now be done in the case of the Sun. Such estimates can be made even now; but the far more extensive data which would result from observations of the kind here considered would give the results greater precision, and throw a great deal of light on the physical conditions prevailing upon the stellar surfaces.

The Heavens.

Our map shows the winter skies in all their splendor, as they would appear to an observer lying on his back and holding the map above his head. The finest part of the sky is in the southeast. In little more than one quarter of the visible hemisphere we find nine stars of the first magnitude—Capella, almost overhead; Castor and Pollux, close together in the east; Regulus, just rising below them; Procyon, to the right of Castor and Pollux, and a little lower down; Aldebaran, high in the southeast; Rigel and Betelgeux, below Aldebaran, at opposite sides of Orion, and the brilliant Sirius, low in the southeast, but far outshining all the others.

In the northeastern quarter there is but one conspicuous group, the Great Bear, low down near the horizon; while in the northwest the finest constellations are Perseus, Cassiopeia and Cygnus, in the Milky Way, the last setting. Pegasus and Andromeda are conspicuous in the west, but the southwest contains, in Eridanus and Cetus, the two biggest and dullest constellations in our skies.

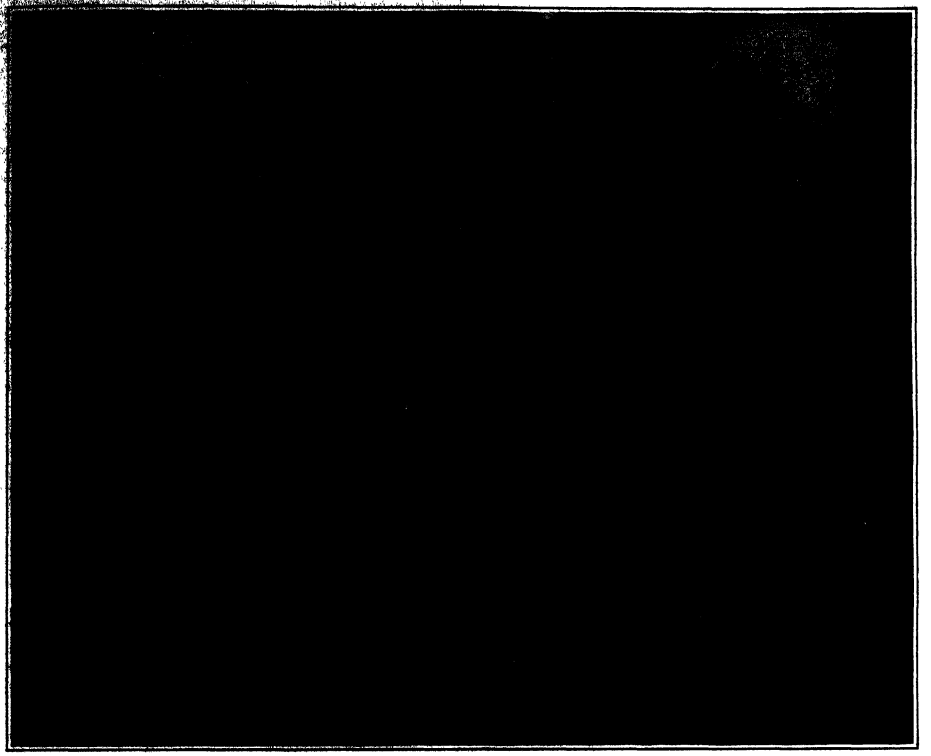
The Planets.

Mercury is morning star throughout the month, and is best visible at its beginning, when he rises about 5:40 A. M. Being north of the Sun, he should be easily visible, appearing like a very bright star, brighter even than Arcturus. On the 15th he rises at 6:30, and he will not be easy to see after this date.

Venus, too, is a morning star, close to the Sun at the beginning of the month, but rapidly coming out into a favorable position. On the 7th, at 10 A. M., she is in conjunction with Mercury, being but 21 minutes of arc south of him (two thirds of the Moon's apparent diameter), and in the same field with a low-power telescope. The two planets should present a beautiful and interesting sight that morning before daybreak.

By the end of the month Venus rises at 4:15 A. M. and is extremely conspicuous. Mars is in conjunction

(Continued on page 446.)



If Gigantosaurus had lived in the twentieth century instead of many million years ago, if he had been a land animal instead of an aquatic creature, and if he could be made to walk up Broadway, New York, the effect would be that which we have shown. Since the creature stood over twenty feet high at the shoulder and had a neck estimated at thirty-six feet long, he could easily have looked over the tops of most houses. The picture is intended to show how enormous Gigantosaurus was, and is not to be regarded as a representation of his habits.

The Largest Known Dinosaur

A Huge Extinct Reptile from German East Africa, the Largest Known Quadruped

By Dr. W. D. Matthew, American Museum of Natural History

IN his "Discovery of America," Fiske points out that the discovery of a new continent, the unveiling of its form and outlines, and placing it correctly on the map, was not a matter of a day or a year. Rather was it a slow continuous progress of successive explorations extending over several generations, each new step adding a little to that geographic knowledge which was far from complete even a century after the death of Columbus.

So, too, is it with the discoveries of extinct animals. Between the time when the first explorer stumbles over a fossil limb bone weathered out and exposed on the surface to the attacks of sun and rain, and the final unveiling of the monster skeleton in a great museum, years must elapse; years of diligent work in excavating, transporting, preparing, articulating and mounting the bones, in restoring the missing fragments, studying the habits, environment, and affinities of the animal and deducing its probable form, and finally in publishing the well considered conclusions.

It is difficult for the layman to make fair allowance for these delays. He sees perhaps a newspaper report of the wonderful new discoveries made by some scientific expedition, and looks forward on his next visit to the museum to seeing the great skeletons installed in its halls. Instead, he is informed that they are "not yet prepared," and for years he hears nothing further. He is very apt to conclude that the report was only a newspaper tale, and to take but little stock in such stories, to discount them all as mainly "hot air."

Perhaps the same skepticism has been rather generally visited on the reports of marvelous finds of dinosaurs in German East Africa by the great expedition from the Berlin Museum. The prodigious skeleton, 130 to 150 feet long, that appeared in the various newspaper illustrations a year or two ago, has not been installed for public view; only two or three of the huge limb bones have as yet appeared. And when it does appear, the proportions and construction are likely to differ as widely from the preliminary sketches as do the modern maps of North America from the strange-looking outlines of a fifteenth century map.

The official report of the results thus far attained by the Tendaguru expedition of the Berlin Museum has just been issued. It contains reports of the field work and of the progress up to date in the preparation and scientific research upon the collections secured, by Director Branca and Curator Janesch of the Berlin Museum. Concerning the Gigantosaurus skeleton, the most interesting of the many important finds made by the expedition, the following data are now available.

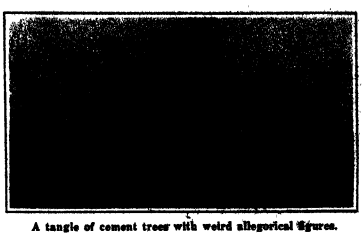
The principal specimen is a skeleton lacking the tail and parts of the hind legs, but believed to be otherwise practically complete. The missing parts are mostly supplemented by other specimens referred to the same species, so that it will be possible to mount a complete skeleton in the Berlin Museum.

It belongs to the group of Sauropoda or Amphibious Dinosaurs, the Giant Dinosaurs *par excellence*. It is distinguished from the Brontosaurus or Diplodocus by the huge proportions of the fore limbs, enormous length of neck, and greater depth of the body. The humerus or upper limb bone is 2.10 meters (6 feet 8 inches) long, as against 4 feet in Brontosaurus and three in Diplodocus, the lower limb is 1.30 meters (4 feet 4 inches), the longest foot bone, 61 centimeters (2 feet), the middle ribs are over eight feet long. The length of the longest neck vertebra is given as 1.20 meters (nearly four feet), there appears, however, to be some doubt attaching to this measurement, as also to the calculated length of neck of 36 feet. There is no question, however, that it was much longer than in Diplodocus.

The animal is now recognized by the Berlin scientists as belonging to the same genus as a partial skeleton discovered in Colorado in 1902 by E. S. Riggs of the Field Museum in Chicago, and described by him as Brachiosaurus. The size and proportions agree quite closely, as was pointed out in *Science* by Dr. F. A. Lucas when the first announcements of the German discoveries were published. Brachiosaurus, therefore, is the proper name of the animal, unless indeed it shall turn out to be identical with a still earlier discovery announced by Prof. Marsh under the name of Baro saurus.

From the measurements and figures given by the Berlin authorities, combined with those of the Brachiosaurus described by Mr. Riggs, I have ventured upon a sketch reconstruction of the entire skeleton, using as a guide the proportions and articulation of the well-known skeletons of Brontosaurus and Diplodocus which have been mounted in the museums of New York, Pittsburgh, and Frankfurt-a-M. While this preliminary

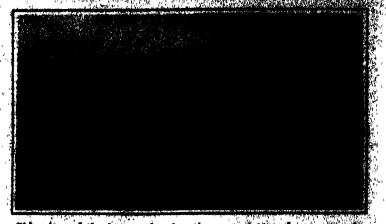
(Concluded on page 446)



A tangle of cement trees with weird allegorical figures.



The cement figure of the Devil.



Side view of the house, showing the cement strawberry mound.

"Garden of Eden" in Cement

ONE of the oddest homes in this country, if not in the world, is to be found in Lucas, Kansas. The old gentleman who owns this home has aimed to reproduce the original Garden of Eden in cement. The house is of the log cabin style, and is built of stone logs, some of which are twenty feet long. The porches, walks, fence, and trees are all made of cement, no wood whatever being used. Near the cabin the owner has built a cement mound for a strawberry bed. The plants grow from holes in the sides. Forty-two tons of cement were used in the construction of this "Garden of Eden."

As the visitor enters the front gate he sees Adam and Eve with arched arms over the walk, and Eve handing an apple to Adam. An immense serpent is twined on one of the trees watching the apple transaction. There are seven cement trees from 30 to 38 feet high and twelve others from 8 to 15 feet high.

On one of the corner trees is to be seen Cain and his wife, and on the next tree Abel (dead) and his wife, while a dog is in an angle of the tree. In one tree is the "All-seeing Eye and Hand," while in another Cain and Abel may be seen making their offering (pumpkin and sheep), while near by are two girls. To the right of the girls are two storks roosting, and back of them is the figure of the Devil. The Devil measures 8 feet in height. He is holding his tail with one hand and a fork with another.

The place presents a weird appearance at night when lighted up, as the owner has installed electric lights in the mouths of the various animals.

If the Garden of Eden really looked as horrible as this we cannot understand why it was necessary to place an angel with flaming sword before it to keep out trespassers.

Largest Bank Vault Door in the World

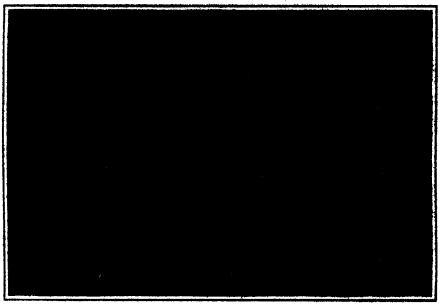
AN enormous door of armor plate has recently been completed at South Bethlehem, Pennsylvania, for the largest bank vault in the world. It will be placed in the new J. P. Morgan building, at Broad and Wall streets, New York. It has taken a year to build the door at a cost of $75,000, and the vault to which it will be attached will cost $200,000. The door and vestibule attached to it weigh 120 tons. The vault will be three stories high. Despite its enormous size, the door has been so accurately constructed that when closed it will make an airtight and watertight joint. Being constructed of solid armor plate a burglar will find it an exceedingly difficult matter to make any impression upon it.

The vestibule of the door is 11 feet 6 inches in diameter, and the door itself 9 feet in diameter, with a thickness of 45½ inches. It is controlled by two 5-inch bolts, which in turn are controlled by two combination locks, and these by a time lock with four movements, so arranged that any one of these movements will permit the opening of the combination lock.

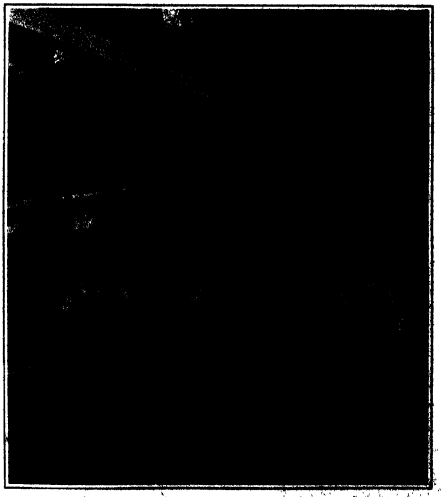
The door swings on a crane hinge with heavy pressure mechanisms to force it to its seat and to make the joint tight. This prevents the introduction of any explosive of a liquid nature. The door, vestibule, and vault are constructed of Harveyised nickel armor plate. These plates are made of the full thickness, and are not held together by screws or bolts, but are dovetailed on the inner edges. After being fitted tightly together wedges are driven on the inside to hold the plates solidly to their place.



A 100 horse-power tractor hauling a twenty-four bottom plow.



Goat-skin water-bottles in the market at Hebron, Palestine.



Enormous vault door that took a year to build.

A 100 Horse-power Tractor

THERE were 30,000 people in attendance at the Power Farming Demonstration at Fremont, Nebraska, this year. They came from twenty-seven different States and were practically all farmers who were interested in power farming, as is shown by the fact that tractors were sold on the grounds into fifteen different States.

The smallest plow on the grounds was a two bottom, and the largest was a twenty-four bottom 14-inch plow. This was used with the big 100 horse-power tractor, which is the property of the Austrian government, but which the manufacturers are unable to deliver on account of the war.

The amount of horse-power that could be exerted by all the machines on the demonstration grounds at one time was 1,000. With the plows they pulled, these machines were capable of plowing in one 10-hour day 750 acres, 8 inches deep.

An Oriental Water-bottle Market

HEBRON, one of the oldest cities in Palestine, has always been famous for its Oriental water-bottles, made of goat skins. Here are to be found large tanneries where these receptacles are turned out by the thousand, and our photograph depicts what is called the "water-makers' market," which is situated to the east of the ancient city. Lying upon the ground in rows may be seen hundreds of goat skins awaiting purchasers. Each skin is inflated, either with water or with air, so that the buyer may know it is perfectly water-tight. The majority of the skins used come from Arabia, while a large number are also received from the Lebanons. They are brought to Hebron by the camel caravans, and are purchased by the tanneries and turned into bottles. They pass through many processes, and a tanner will spend a week upon a single skin before it is rendered water-tight and serviceable. From Hebron these old "bottles" are sent to all parts of the East, thousands going down into Egypt and the Soudan every year. They are also used as rafts. A number of inflated skins are attached to a light wooden frame, which then not only readily floats, but is capable of carrying quite a heavy load. Such craft are to be seen upon the rivers of Syria, and also upon the Euphrates and Tigris.

Adverse Decisions in Interference.—A new practice has been established in connection with interferences involving letters patents. If in such interference a decision is rendered adverse to the patentee, there is printed in the Official Gazette of the Patent Office a note to the effect that on the date given a decision was rendered that the patentee was not the first inventor of the subject matter covered by certain claims or claim specified of his patent, by number, and that no appeal having been taken within the time allowed, such decision had become final.

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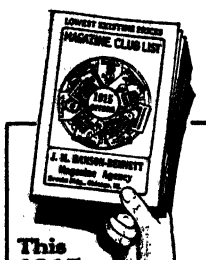
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Ultra-violet Rays for Water Purification

(Concluded from page 448.)

who had charge of this apparatus, reported that it was invaluable in enabling him to get pure water for washing wounds, and that he had not had a single case of operatory infection since using the water thus sterilized. The Austrians have also been using a field sterilizer of this kind during the past few years. The accompanying illustration shows the manner of equipment at the present day in the Austrian army. This consists of an artillery car on which is mounted a small gasoline motor generator set of about 2½ horse-power, a water pump, a filter, and an ultra-violet ray sterilizer. The body weight of the entire outfit is about 2,000 pounds. When in use a hose 15 to 20 feet in length connects the pump with the source of supply. The water is then pumped through the filter to the sterilizer, which is placed outside of the wagon, on a folding tripod. Six spigots are supplied so that a number of men can fill their pots or canteens at once.

The great advantage of this method is that the apparatus can begin delivering sterile water within ten minutes of starting the gasoline set, and less than this time is required to pack up the outfit and move to another water supply. One man alone without any great technical knowledge can operate this outfit. This type of army sterilizer has been submitted to elaborate maneuvers, in addition to very rigid army tests, and has given remarkable satisfaction and service.

Thus the germicidal properties of ultra-violet rays are applied in assuring an army sterile water, both for drinking and surgical purposes.

The Loss of the "Audacious"

(Concluded from page 447.)

the menace of mines and submarines, the British battleship fleets are probably gathered at certain bases on the North Sea coasts of England and Scotland, where they are thoroughly protected by mine fields. Here they are in touch with the scouts, protected cruisers, destroyers, etc., which are patroling the German coasts and the entrance to the Baltic, ready to flash the news to the main fleet, should the Germans attempt a sortie.

How then, it will be asked, did it happen that the "Audacious" was on the northerly coast of Ireland, and what was she doing there, so far from the North Sea blockade. The answer is to be found in the necessity for keeping the gunners tuned up to their work by target practice. Target practice must be done in the open sea, and involves steaming over considerable distances. Obviously the submarine-infested waters of the North Sea, mine-strewn as they are, involved too great a risk; and hence, the Admiralty selected for practice grounds, waters remote from the North Sea.

Lough Swilly, near which the disaster occurred, is a naval base, and the "Audacious," at the time of the accident, was about twenty miles off shore, and was just turning to make her run past the target. She is stated to have been in squadron formation with four other ships. From this we infer that the ships have been sent away from the North Sea, a squadron at a time, for battle practice in supposedly safe waters.

The fact that the "Audacious" was struck aft on the port quarter, near the engine room, has led to the suggestion that the blow was that of a torpedo, fired from a submarine—this for the supposed reason that, if a ship runs against a mine, she must necessarily strike it head on and be damaged in the forward portion of the hull. But the ship was turning to make the run past the target. This turn is made with the helm well over, and under these conditions the ship pivots sharply about her stem, the stern swinging over to port or starboard (to port in this case). There is a marked lateral movement of the ship during the turn, and the bow might clear a mine which the after portion of the ship would override. This is what happened to the "Audacious."



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To the naval constructor, the most staggering fact is that a single mine should have sent so modern a battleship to the bottom. Such ships as the "Audacious," the "New York," the "Kaiser," were believed to be so thoroughly subdivided as to be capable of taking the blow of two or even three torpedoes without foundering. Perhaps they could, if the torpedoes were of the older patterns, carrying from 100 to 150 pounds of high explosive; but the latest torpedoes carry between 250 and 300 pounds, and a mine may carry 500 pounds.

The Germans are doing everything on a big scale in this war, and it would be like them to make their mines of the most deadly character. The destructive energy of a mine increases as the cube of its charge. A 500-pound mine would let loose within a ship a volume of gases at high pressure that might so wrench the whole internal structure in the neighborhood of the blow as to set up a slow leakage that would gradually, as in the case of the "Audacious," destroy all her buoyancy.

The "Audacious," completed last year, was of 23,000 tons and 21¼ knots speed. She mounted ten 13.5-inch guns in five center-line turrets and a torpedo battery of sixteen 4-inch guns. Her side armor was 12 inches at the waterline, decreasing to 7 inches at the main deck. Her complement of officers and men was 800.

Our illustration, taken from the deck of the Olympic, while her boats were taking off the crew, shows the ship, down by the stern, with a marked list to port. It will be noted that she is stripped for battle practice, the rails being down and the ensign (the ensign flagpole having been unshipped from the stern) being flown from a pole on the starboard side of the after bridge.

The Heavens in December

(*Concluded from page 442.*)

with the Sun on the 16th, and is invisible this month

Jupiter is evening star in Capricornus, setting about 9:40 P. M. on the 1st and 8:10 on the 31st, and is the brightest object in the evening sky.

Saturn is in opposition on the 21st and is visible all night long. He is in Gemini, at his greatest northern declination, and splendidly placed for observation. His rings are opened out at their widest angle, and he appears to the naked eye even brighter than Capella, and is excelled only by Sirius.

Uranus is evening star in Capricornus, too low in the west to be comfortably seen.

Neptune is in Cancer, approaching opposition, his position being 8 hours 9 minutes 16 seconds, plus 19 degrees 43 minutes on the 3rd, and 8 hours 6 minutes 46 seconds, plus 19 degrees 52 minutes on the 31st.

The Moon is full at 1 P. M. on the 2nd, in her last quarter at 7 A. M. on the 10th, new at 10 P. M. on the 16th, and in her first quarter at 3 A. M. on the 24th.

She is nearest us on the 15th and farthest away on the 27th. In her circuit of the sky she passes near Saturn on the 4th, Neptune on the 6th, Venus on the 15th, Mercury on the 16th, Mars on the 17th, Uranus and Jupiter on the 20th, and with Saturn once more on the 31st. The conjunction with Jupiter, which occurs at 8 P. M. on the 20th, is very close.

At 11:15 A. M., by Washington time, on the 22nd the Sun reaches his greatest southern declination, and, in the almanac phrase, "winter commences."

Princeton University Observatory.

The Largest Known Dinosaur

(*Concluded from page 443.*)

reconstruction will doubtless have to be modified to some extent when the preparation and mounting of the Berlin skeleton is completed, which may not be for some years to come, yet it serves to show approximately the gigantic proportions of the animal, its extraordinary length of fore limbs and neck, and the great depth of body. The tail seems to have been much shorter than in *Diplodocus* and *Brontosaurus*. The huge size is shown by

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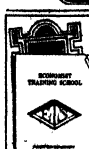
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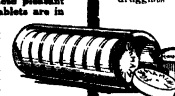
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contrast with the outlines of the Imperial Mammoth, the largest of the American mammoths, and with a man of average height. One group only of living animals, the whales, equal or surpass the Brachiosaurus in bulk. No four-footed animal, living or extinct, can equal it. It lived about the beginning of the Cretaceous period, contemporary with its American relatives; but while these inhabited the fresh-water lakes and bayous which then extended along what are now the flanks of the Rocky Mountains, the remains of the African species are found in salt-water formations deposited in the coast swamps and protected inlets along the old East African shores.

The Berlin authorities believe that the animal was amphibious. I have advocated the view (propounded many years ago by Owen and Cope) that these so-called Amphibious Dinosaurs were really entirely aquatic, necessarily so because of their gigantic size, which would make it a physical impossibility for them to emerge entirely on dry land. The larger an animal is, the less is the strength of his muscles relative to their weight, a corollary of the well-known mechanical law that the strength of a beam varies as its cross-section, the weight as its bulk. As long as these animals were in the water their weight would be largely buoyed up, and they could attain, like the living whales and various extinct sea-monsters, a size that is impracticable for a terrestrial animal. Thus, too, they would be out of reach of the great carnivorous dinosaurs of the land, against whose attacks they had apparently no such means of self-defense as the land dinosaurs possessed. It is, of course, obvious that they were adapted for wading on the bottom, not for swimming, although no doubt they could swim as well.

Accoring to this theory, the Gigantosaurus acquired his huge forequarters and long neck in adaptation to living in deeper waters than his relatives. While the gigantic dinosaurs of this country are found in fresh-water formations, this animal probably lived in an environment such as may be found to-day in the series of bays and inlets along our South Atlantic coast from New York to Florida. Here he could wade about in the shallower waters, feeding upon the luxuriant tropical vegetation that fringed the protected shores and retreating to deeper waters when attacked by the fierce carnivorous dinosaurs of the land. After death the carcass would usually be more or less dismembered and pulled apart by fishes or aquatic carnivora before it drifted into a quiet spot and was buried in the slowly accumulating mud.

The subsequent geologic ages, which piled successive deposits of sand and clay above him and finally brought his remains again to the surface after millions of years of burial and slow petrifaction, have witnessed vast changes in the world of life. The various dinosaurs, terrestrial and aquatic, which were his contemporaries, and the great variety of land and water life of his time became extinct, only to be succeeded by another long period of evolution of new kinds of dinosaurs of even more extraordinary types, although none attained the gigantic size of the Sauropoda. Then these in turn disappeared, and the way was left clear for the evolution of the mammals or higher vertebrates into the various types of living quadrupeds, and toward the end of this long period, in some region yet unexplored, the progenitors of man evolved from the monkey ancestry into the culminating type of evolution.

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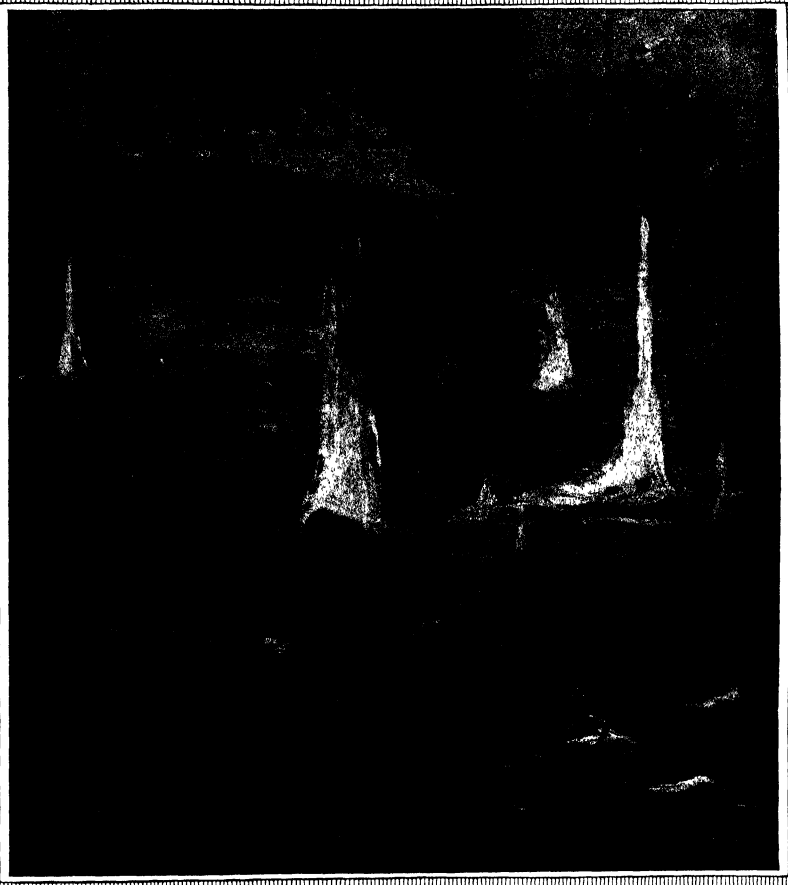
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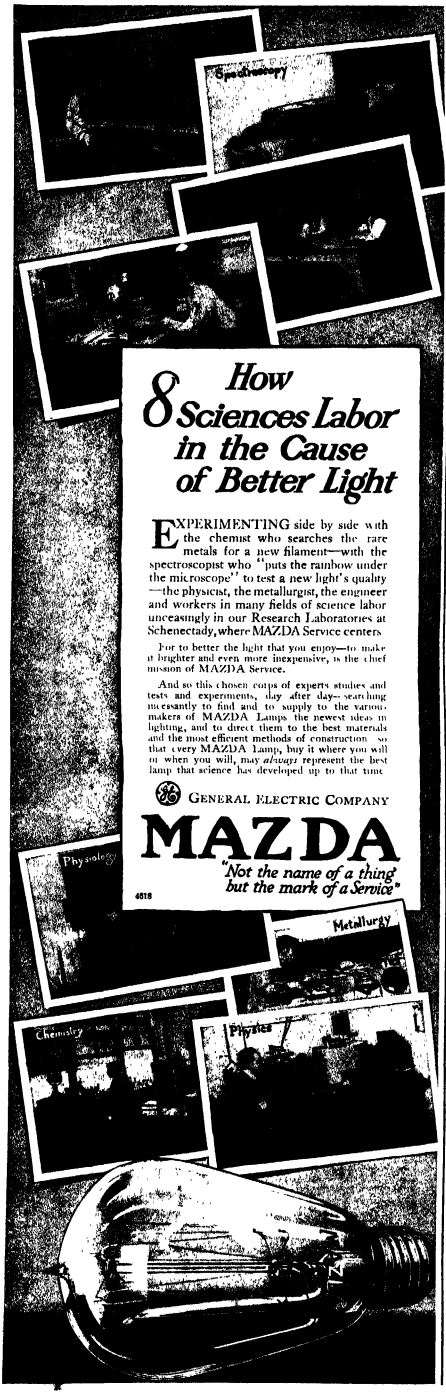
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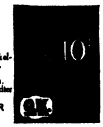


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The Action in Which the "Carmania" Sank the "Cap Trafalgar"

EARLY in the forenoon of Monday, September 14th, the auxiliary cruiser "Carmania," formerly a popular passenger vessel of the Cunard Line, observed the island of Trinidad ahead and altered course to pass close to the west extremity. Shortly after 11 A. M. she made out a vessel off the western end of the island, and, later, saw that there were three steamers, one a large liner, the others colliers. The latter had derricks topped, and they were probably working when the "Carmania" hove in sight.

Before she had raised their hulls above the horizon, the ships had separated and were making off in different directions. The large vessel was apparently of about the same size as the "Carmania," and her two funnels were painted to resemble a British liner of the Castle Line.

After running away for a little while, the large steamer, which eventually proved to be the German liner "Cap Trafalgar," turned to starboard and headed toward the "Carmania." The weather was fine, with a moderate breeze. The speed of the "Carmania" was 16 knots and that of the "Cap Trafalgar" about 18 knots.

At 8,500 yards, the "Carmania" fired a shot across the bows of the enemy, and he immediately opened fire from his starboard after gun. The "Carmania" replied with all her port guns and the firing became general. The ships were now well within range, and, as most of the enemy's shots were going over, the "Carmania's" rigging, masts, funnels, derricks, and ventilators all suffered. The "Cap Trafalgar" was then well opened on the "Carmania's" port side, and all of the starboard and port guns of the respective ships were firing rapidly.

Owing to the decreasing range, the machine guns of the "Cap Trafalgar" were becoming particularly dangerous; so the "Carmania" was turned away from him and the range opened.

[illegible] of the "Carmania's" [illegible] seen to stumble the [illegible] guns, unexplosive, and [illegible] that he was [illegible] forward [illegible] to stop [illegible] one of the [illegible] projectile passed through the "Carmania's" cabin under the fore bridge, and, although it did not burst, it started a fire which increased rapidly, no water being available owing to the fire main having been shot through, and the chemical fire extinguishers proving of very little use. The fire got such a firm hold that the fore bridge had to be abandoned, and the ship had to be fought from the after bridge, the lower steering position being used.

By this time the "Cap Trafalgar" was on the starboard bow of the "Carmania" and showed a heavy list to starboard; and at 1:50 P. M., or one hour and forty minutes from the firing of the first shot, she capsized to starboard and went down bows first, with colors flying.

It was some time before the fire was got under control and it was only possible to do this by keeping the ship before the wind. Consequently, the "Carmania" could not go to the assistance of the survivors, some of whom got away in boats and were picked up by one of the colliers.

The enemy, before sinking, was in wireless communication with some German vessel; and, as smoke was seen on the northern horizon, and the signal man thought he could make out a cruiser's funnels, the "Carmania" made off at full speed to the southward, altering course at dusk for Abrolhus Rocks. The ship was by this time in touch with the cruiser "Cornwall," and asked him to meet her, as the ship was unseaworthy, and practically all communications and navigational instruments on the bridge had been destroyed by the enemy's fire, rendering the conning and navigation of the ship difficult and uncertain.

On the 15th, at 4:30 P. M., the cruiser "Bristol" picked up the "Carmania" and escorted her until she was relieved by the "Cornwall," which took the "Carmania" on to Abrolhus Rocks, where the ship anchored to effect temporary repairs. The "Cap Trafalgar" was armed with 4-inch guns and the "Carmania" with either 4-inch or 4.7-inch.

The "Cap Trafalgar" directed her fire at the bridge and upper works of the "Carmania," seeking thus to put her out of action; the "Carmania," on the other hand, directed her fire at the water-line of the "Cap Trafalgar," destroying her stability and causing her to heel over and go down.



After bridge of "Carmania," showing one of her rapid-fire guns.



Wreckage on the bridge of the "Carmania."

THE ACTION IN WHICH THE "CARMANIA" SANK THE "CAP TRAFALGAR"

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Silent War

ONE of the great surprises of the war, at least for the general public, has been the complete inactivity of the battleships and battle-cruisers of Great Britain and Germany. When war was declared, and the mighty fleet which had just been reviewed by King George disappeared suddenly to the eastward, the world awaited with breathless interest the first tidings of that long-talked-of battle between dreadnoughts, which was now, apparently, about to be fought somewhere in the North Sea.

Though the war is now over four months old, the public is still awaiting that Homeric contest; and the way things are going, it will be many months, and possibly two or three years, before the rival battleships line up against each other for a decisive fleet engagement—if indeed that engagement ever takes place.

When we bear in mind the enormous size and strength of the two navies, it will be seen that such cruiser and submarine actions as have occurred must be regarded as mere outpost affairs, which have had practically no effect upon the first-line fighting strength, either of Great Britain or Germany. The dreadnoughts of the two navies total together nearly half a hundred ships. For four months they have been within a few hours steaming of each other and keyed up to the highest pitch of fighting efficiency. Yet in all this time not a single gun has spoken!

To the naval strategist this silence is the token of a victory as complete as any that could be won by the shock of 12-inch salvos and the wrecking of armor belts, turrets and barbettes; for it is the unspoken evidence of the persistent, remorseless pressure of the most remarkable blockade in all the history of naval warfare.

Incidentally, this silent victory is a striking example of the controlling, the absolutely decisive advantage conferred upon the nation which obtains the complete command of the sea—a subject which for many years past has formed the principal theme of the lectures and writings of our own Capt. Mahan.

The command of the sea! Let us consider what the acceptance of the blockade of her main fighting fleet has meant to Germany.

In the first place, it has resulted in the complete disappearance from all the seven seas of her vast merchant marine, such of her ships as escaped capture having fled to neutral ports or to her own protected bases on the North Sea and the Baltic. Her colonial possessions, in the acquisition and upbuilding of which she has expended so much energy and treasure, being absolutely cut off from any military or naval assistance, have passed one by one to the enemy. Her warships on foreign stations, after a series of exploits in commerce destroying and engagements with the enemy, which will form one of the brightest chapters in the history of her navy, are being gradually sunk or driven into neutral ports. Finally, her overseas trade, except through a few neutral ports, has ceased to exist.

But it is not in these respects that the silent victory of the war is making its pressure most keenly felt in this life-and-death struggle of the great German Empire. It is in its bearing upon the military operations in France and Belgium that the British command of the sea is exercising an influence, so dominant that it already promises to be the decisive factor in the whole situation.

Had the conditions been reversed; had the German fleet been superior in strength; or had the weaker fleet, by virtue of its superior *material*, personnel, strategy and tactics, been able to defeat the British and French in a series of decisive engagements, not a single regiment of British troops could have been sent to the western theater of war.

As it is, the enemy's troopships come and go with absolute impunity, while within a few hundred miles, the second strongest battleship fleet in the world lies impotently at anchor and watches the gradual recruiting, training, and transportation to the fighting line of some two million armed troops of the enemy, without being able to strike a blow to assist the valiant German army of the west.

Herein is a lesson in the value of the command of the sea, the moral of which we of the great Republic of the Western Hemisphere should lay well to heart.

Arms and the Man

AMONG the unexpected developments of the war, none has been more amazing than the unflinching steadiness with which the citizen soldiers of the warring nations, and especially those engaged on the western battlefields, have faced the murderous attack of modern weapons, whether by the magazine rifle, the machine gun, the searching shrapnel, or the shattering, high-explosive, 16-inch shell!

So accustomed have we become, through the daily testimony of eyewitnesses, to the more-than-human courage with which frail flesh and blood is facing, day in, day out, and for weeks together, the tornado of lead and steel which sweeps over the modern battlefield, that we are forgetting that only yesterday we were all saying that this miracle could not be. Had not the military experts themselves assured us that the accuracy and volume of modern rifle, machine-gun, and shrapnel fire was such, that not the finest troops in the world could be brought to face the tempest in a frontal attack in the open?

And yet this very thing has happened—not merely once, to be written into the chronicles of a nation's sublime heroics, but everywhere and every day throughout that far-flung battle line on which Teuton is locked in the death-grip with Frank and Briton.

Marvelous, also, is the fact that this matchless courage is being displayed, not by the toughened veterans of a long campaign, not by professional soldiers, steeled and tempered by the discipline of barracks and camp, but by work-a-day laymen, called at a minute's notice from the peaceful routine of their daily lives, and told to rush "into the jaws of Hell"!

Consider them, as they advance through the zone of death, compact, unwavering, and with every emotion save that of fear shining in their eyes. They have come, not from the snug shelter of the camp, but from the endless misery of the trenches in which, when man was not lashing them with lead and iron, nature has whipped them with wind and sleet and pitiless rains. Sodden, unfed, cold, and weary, they face the multiplied savagery of modern artillery with a heroism that the veterans of Napoleon, Blücher, and Wellington can scarce have equaled in the days of the less murderous smooth-bore and muzzle-loading musket.

Man need not be brutal to be physically brave.

Never, since the time when men first marched into battle, have armies taken the field in which there was such a high average of education and refinement as in these contending hosts on the French and Belgian battle grounds. Among these four or more millions of men we doubt if a corporal's guard can be found that is not able to read and write. And the grade of culture extends from that of the state schools up to the highest erudition of the colleges and universities.

War may be brutal; but the deeds of the citizen-soldier in this unparalleled test of the twentieth century, have proved that there is not the remotest relation between brutality and bravery. Rather, we have learned that the mental, moral, and artistic uplift of the age we live in, so far from stripping the race of the sterner qualities of manhood, has stiffened immeasurably its pluck, tenacity, and courage.

German Colonies as Outposts of Science

IF the Allies should win decisively in the great war, what will become of the German colonies? Some of them have already been wrested from the Fatherland, and in the case of at least one—Kiaochau—the present possessors have announced that their capture will never be restored to its recent owners.

If the above question is interesting on account of its political and economic aspects, it is no less so from the point of view of pure science. In fact, we are inclined to think that German colonization has been more fruitful in a scientific sense than in any other. Neither as commercial enterprises nor as homes for the surplus population of the parent country have the German dependencies been conspicuously successful. According to the latest statistics, these possessions had an aggregate population of 14,850,000, of whom only 24,170

[illegible] SCIENTIFIC AMERICAN [illegible]

[illegible] 1900 [illegible] small town in one of the [illegible] of Great Britain—Canada, [illegible] —could muster a larger number [illegible] in some cases, a larger standing [illegible] entire colonial empire of Germany [illegible] emigrate to the German colonies [illegible] United States, Canada, and [illegible] strategic value of most of these [illegible] gible. Germany, like any other [illegible] fortified coaling stations and dockyards [illegible] parts of the world for the use of her navy, but could derive no military advantage from vast tracts of [illegible] cal jungle or archipelagos of atolls in the South Pacific; in fact, as the event proved, these possessions were merely an embarrassment in warfare.

In the years 1909-1910 Prof. Hans Meyer and his collaborators published the two sumptuous volumes of a monumental geographical work called "Das Deutsche Kolonialreich." In America, except to those of us who had seen the material of which this work is a digest in process of accumulation in such journals as the *Mitteilungen aus den deutschen Schutzgebieten*, *Petermanns Mitteilungen*, and various other *Fachzeitschriften*, the contents were a revelation—not of the extent to which the German possessions had been exploited commercially and politically, but of the thorough-going way in which each of them had been studied and explored by German geographers, geologists, ethnologists, climatologists, zoologists, and botanists.

German colonization in Africa began just thirty years ago, about the time when the great journeys of exploration in that continent were beginning to give place to intensive research. Here was a new world for German science to conquer. Germany sent, not her soldiers, her traders, and her missionaries, plus as other colonizing countries had done, but she also sent to each of her colonies a strong corps of scientists, whose work was, for the most part, done under official auspices. Just to cite one phase of this work, each colony was soon dotted over with meteorological stations, the observations at which were taken by petty officials, planters, missionaries, and others, and ultimately published in great detail at Berlin, so that at the present day we possess more complete climatic statistics for German East Africa, German Southwest Africa, Kamerun, and Togo, than for any country in the Balkan peninsula except Roumania.

In short, the acquisition of a virgin country by Germany means the prompt accumulation of an immense fund of scientific knowledge concerning that country—collected with conscientious thoroughness, digested by experts, and presented to the world in a form that is a delight to the eye as well as to the understanding. The work of Meyer, already mentioned, with its profusion of statistical charts, photographs, aquarelles, tables, and descriptive text, is typical.

The scientific tasks undertaken by the Germans in their colonies are, of course, perennial. How well will they be carried onward by any possible successors? In all British countries it is notorious that scientific research receives but lukewarm encouragement from the government unless it can promise immediate material results. Much of the scientific work done in the German colonies would certainly be viewed askance by British administrators, though private enterprise would doubtless in some measure make amends for the lack of official support. The French government is more inclined than the British to give its moral support to pure science, but intimately less inclined than Germany to devote public funds to the same object. France has done little for scientific investigations in French Congo compared with what Germany has done in Kamerun. Belgium need not be considered, as she has her hands full with the Congo, while Russia would not know what to do with an African colony.

Strong Magnetic Field for Solar Research.—MM. Deslandres and Parot continue, in the *Comptes Rendus*, an account of their experiments on the production of intense magnetic fields. This work has an important bearing on researches on solar magnetic fields. A very interesting part is that the judicious use of intense electric currents is more effective in constructing powerful electro-magnets than is the saturation of large masses of iron. Instead, therefore, of following along the lines of Weiss, whose truly ponderous apparatus weighs about 100 tons, they are constructing comparatively light and small electro-magnets. They have been able to [illegible] their new method of water cooling the magnetizing coils, and a field of 50,000 gausses has been obtained without the use of iron; this estimate being based on the value of the field on one of the zinc lines. They use flat [illegible] instead of wire in their coils, and the cooling property of water flows across instead of along the axis of [illegible] from the authors' hope, to produce a field of [illegible] gausses but finally work has been [illegible] and has been permanently interrupted by the [illegible]

[illegible] ...—The naval estimates [illegible] ...ming July 1st, 1915, call for [illegible] ...about $144,000,000. This happens [illegible] ...was authorized in the naval [illegible] ...the last session of Congress. The [illegible] ...bill practically call for the construction [illegible] ...six torpedo-boat destroyers and eight [illegible] ...tank, which is the same as the addition [illegible] ...authorized in the bill passed at the last session.

[illegible] Not Beamed?—According to the *Navy* [illegible] ...recently made under the direction of Com- [illegible] ...Robinson, U. S. N., commanding the [illegible] ...station at Newport, Rhode Island, which [illegible] ...proves that the torpedo net is no longer a [illegible] ...against the torpedo. In the experiment [illegible] ...with a heavy charge of gun cotton was fired [illegible] ...the torpedo boat "Morris," while she was running [illegible] ...knots, at a steel net which was moored to [illegible] ...the target. The torpedo went through the net, [illegible] ...the target, and exploded.

[illegible] in Marine Turbine Construction.—Up to the [illegible] ...time the total horse-power of marine turbines [illegible] ...Parsons type, completed and under construction [illegible] ...the works of the company and of its lessees, as well [illegible] ...in the works of the continental companies, etc., [illegible] ...amounts to about 12,360,000 horse-power, an increase [illegible] ...during the past year of about 1,760,000 horse-power. [illegible] ...this total about 10,800,000 horse-power is employed [illegible] ...the propulsion of warships, and over 1,850,000 [illegible] ...horse-power is in vessels of the mercantile marine and [illegible] ...in yachts.

Rubber Roads.—Considerable interest has prevailed in England for some time over the suggestion of using rubber for street pavements. Trial sections of such pavement were laid in the Old Kent Road, in London, some time ago, as this street carries some of the heaviest traffic of the city; and recently a specimen of this pavement was exhibited. The wood block pavement adjoining had worn down from an eighth to a quarter of an inch, but in the same time the rubber-capped wood blocks appeared as good as new; and it would appear from these tests that rubber pavements would be so durable as to make them an economic investment.

New Alpine Railway.—The longest Alpine railway in existence will run from Brieg, near the Italian border, to Disentis and will thus connect the former with the Federal Swiss lines. Beginning at the end of the Simplon tunnel, at 2,200 feet above sea level, this remarkable road passes directly over the Saint Gothard tunnel as a surface road at 4,700 feet above sea level and rises at one point to 7,100 feet. With a branch of an existing road, the new line will connect Brieg with Saint Moritz, between which points daily runs will be made each way and afford tourists a route of surpassing beauty through the hitherto remote and little known region of the upper Rhone and past the headwaters of the upper Rhine.

Navy Yard Bid the Lowest.—The Government navy yard at Mare Island, California, made an unofficial estimate of the cost of constructing one or more of the new 1,110-ton destroyers for the United States Navy. When the bids for these vessels were opened, it was found that the Mare Island bid was about $200,000 less for each destroyer than the bids submitted by private shipbuilding firms; and, as a consequence, Secretary Daniels has intimated that part of this work would be given to the yard on the basis of its figures. The Mare Island estimate was, for a single destroyer, from $626,670.00 to $674,917.00, according to the type of machinery and boilers installed. For building two destroyers, the estimate was from $12,500.00 to $17,000.00 less than for one. The new class will carry four additional torpedo tubes as compared with the previous class and two anti-balloon guns, and the speed is to be 29½ knots.

The Lights of London.—The dimming of the lights of London, which has been deemed necessary by the authorities as a protection against aerial attacks, has brought forcibly to the attention of illuminating engineers the great waste of light that has been universal in the past; and this condition prevails not only in London, but in every other city in the world. It is pointed out that in the case of shop windows there has been little endeavor to concentrate the light on the wares displayed, with the results that much light is wasted, and the excess is injurious to passers-by. Under these conditions the expenditure for light largely fails to secure the best returns, for the wares are not lighted to the best effect, and if the misdirected light is unpleasant to the passers-by he will not stop to observe. The same conditions prevail to some extent in the case of the powerful arc, flame and high pressure gas lights used for illuminating the streets; for it is felt that the illumination from these could be controlled and directed so as to secure a better distribution of lighting, and at the same time be more agreeable to the eye. Heretofore illuminating engineers have worked chiefly empirically in the interests of the various companies, but the economies will doubtless be taken advantage to consider this comparatively [illegible]

Electricity

Mercury-vapor Wireless Apparatus.—Peter Cooper Hewitt, well known for his invention of the mercury-vapor lamp and rectifier, has been working for the past few years to discover a means of employing the rectifying properties of the mercury-vapor tube for the receiving and transmitting of radio-telegraph and telephone signals. He now reports that he has succeeded, but is not ready as yet to give out detailed information on the subject.

Selenium for Measuring X-rays.—Selenium can be used to measure the strength of X-ray tubes. The rays are directed upon a selenium cell, according to a recently patented process, and the cell is placed in one branch of a Wheatstone bridge. Measuring the resistance of the cell when the rays fall upon it, this resistance is found to drop by an amount which, as in the case of light rays, depends on the strength of the X-ray tube. The present system includes some special methods of connecting up the selenium cell with the bridge and galvanometer so as to secure the best conditions for practical use.

Electric Benzine Process.—It is reported from Sweden that a Stockholm engineer, M. Vidstrand, has lately succeeded in perfecting an electric process by which he extracts benzine from coal. The method is not as yet made public and the details will be awaited with interest. It is claimed that the cost of production on the electric method will be considerably less than for the customary benzine processes. The resulting product answers all the requirements for a good fuel for automobile or other motors. The inventor has applied for patents in 18 different countries, it is said, and is making efforts to operate the system on an industrial scale. Where electric current can be had at a low rate, for instance, from hydraulic plants, such a method can be used to advantage.

Finding Pipes by Electrical Method.—Piping of various kinds such as gas, water, steam-heating, vacuum cleaning or compressed air, is often concealed within walls, generally under plaster, and when it comes to making repairs or replacing such pipes, their exact position cannot always be found without doing considerable damage to the wall. A recently-patented electric method for locating the pipes is simply a special application of the well-known induction balance principle. A convenient apparatus is made up consisting of two sets of coils placed on ends of a magnet bar. One set of coils receives alternating or vibratory current from a suitable source, and the other coils are connected to a telephone. The balance is first established so that no sound is heard in the telephone. When the device comes near the metal piping, this disturbs the balance and a sound is heard. It is thus an easy matter to find the exact position of the pipes and to reach them with less damage to the wall.

Hour-glass Electric Switch.—A European patent provides a convenient method of putting on an electric circuit for an exactly determined length of time. By the use of the hour-glass principle the device can be made with scarcely any mechanism. The action depends on the use of a pivot arm which can swing from one side to the other in order to control a contact. Supposing an hour-glass to be elongated and to take the shape of a glass bulb at top and bottom, connected by a tube; by pivoting the tube at the middle, the system can be made to swing about. With the top ball full of sand, its weight makes it incline to the right, limited by a stop, and the lower empty ball lies to the left. Allowing the sand to flow from the top into the bottom bulb, when enough enters the lower ball its weight causes it to drop and move to the center line. Without going into details, it will be seen that this movement can work electric contacts, and the hour-glass principle controls the time in which the contact is left on. Current can thus be put into any circuit for the standard length of time for which the hour-glass is adjusted.

Rotary Lamp Synchroniser.—A new rotary lamp synchronizer for use on switchboards of central stations to indicate whether alternators are running in step, combines the best feature of the motor type of indicator, but uses lamps which are lighted up in succession, so that it really has no moving parts. A set of 12 incandescent lamps is mounted in a circle in the box with a glass front, the lamps being connected to the secondary windings of a special 3-phase transformer whose primary is suitably wound to suit the voltage and frequency of the circuit. Secondary windings are arranged to give six equal voltages having equally spaced phase angles, a pair of lamps being connected across each voltage, the voltage of the incoming machine being connected to synchronize with one of the six secondary voltages. Two lamps of a pair are mounted at opposite ends of a diameter on the circle, and as one machine gradually overtakes the other, the lamps light up in rotation, thus giving the appearance of a revolving band of light. The direction of movement with reference to an arrow head indicates whether the incoming machine is running "fast" or "slow," and the right moment of synchronism is shown by the full brilliancy of one pair of lamps which far exceeds the ones before and after.

Science

Silk from Seaweed.—Dr. L. Sarasin has succeeded, according to *La Nature*, in making artificial silk from the "slime" of the seaweed which is thrown up in immense masses on the coasts of Normandy, Norway, Scotland, and Canada. An English company is said to be exploiting the process, for which a great future is predicted.

Sir Ernest Shackleton and the transantarctic section of his expedition sailed from Buenos Aires on the "Endurance" October 27th for South Georgia, from which point, as soon as a favorable opening is found in the ice-pack, the party will proceed southward. It is now intended to winter the "Endurance" in the Antarctic, instead of sending her back to Buenos Aires, as was originally planned.

Microbes that Feed on Rubber.—Commercial rubber which is kept in perfectly dry air is not capable of furnishing nutriment to any form of microbe, according to a note in the *Bulletin* of the Pasteur Institute (Paris), but in the presence of sufficient moisture it may be attacked by certain bacteria or molds which feed on albuminoids, resins, and sugars. Some microbes form red, yellow, brown, or black spots on rubber without sensibly altering its properties. But there are two species of Actinomyces (*Act. elastica* and *Act. fuscus*) which are able to assimilate the hydrocarbon of rubber, and which may therefore so modify its properties as to destroy its value.

Memorial Tablets for Two Antarctic Explorers.—Two large bronze tablets, bearing appropriate bas-relief scenes and inscriptions, have been placed in the lower hall of the American Geographical Society, New York, one in honor of Lieut. Charles Wilkes and the other of Capt Nathaniel B. Palmer. The inscriptions set forth the Antarctic discoveries of these two American sailors, and call attention to the fact that each discoverer is deservedly eponymous of the region whose existence he made known to the world. This is a timely reminder of the fact that the name "Wilkes Land" was spread over the whole coast of East Antarctica some generations before Sir D. Mawson applied it to a very minor portion of that coast.

The Problem of Protecting Against Earthquakes in Italy is discussed in a recent memoir by Prof. G. Agamennone, who points out that disasters from this cause are mainly due to faulty construction and bad location of buildings. It appears that after the greater earthquakes of recent times the authorities have formulated rules to ensure proper reconstruction, but these have been disregarded on account of the expense entailed and because the danger of another earthquake seemed remote. The author thinks the Italian government should establish a special ministry to control and systematize the work of mitigating the results of earthquakes, volcanic eruptions, flood, and other analogous disasters, and should provide state insurance against the losses due to these agencies.

The Value of Carbonic Acid Gas as a Plant Nutrient has been the subject of considerable recent literature, including an interesting paper by H. Fischer, describing experiments in Germany. The author found that the development of both foliage and flowers was stimulated by an excess of carbonic acid in the air, while the yield of tomatoes was doubled and that of cucumbers increased 12.5 per cent by carbonic acid treatment. It has generally been held that 0.03 per cent of carbon dioxide in the air is sufficient for plant growth, but Mr. Fischer thinks that more than this can be utilized, provided there is ample light, and that experiments in this direction might give valuable results. On the other hand, Mr. I. F. Kidd, an English investigator, finds that an excess of carbon dioxide in the atmosphere retards or inhibits the germination of seeds, but without injuring them. He suggests that the production of carbon dioxide in nature by the decay of vegetable matter may play a part analogous to that noted in his experiments.

Seismic Activity Near Charleston, S. C.—Few people realize that earthquakes still frequently occur in the epicentral region of the historic Charleston earthquake of August 31st, 1886, yet such is the case. In the *Bulletin* of the Seismological Society of America Mr. Stephen Taber states that during the past fifteen years those shocks have occurred at the average of one in every two months. Eight were recorded in 1912, and that of June 12th, 1912, was more severe than any felt in the district since 1886-1887. There has, however, been a gradual though irregular decrease in the frequency of shocks since 1886. The author believes most of these earthquakes to be due to adjustments taking place along a fault in the crystalline rocks underlying the Coastal Plain formations. Any factor increasing the relative pressure on the northwest side of the assumed fault, or decreasing it on the southeast side, tends to bring about a readjustment of the strata, with accompanying earthquake shocks, the most important of these factors being rainfall, height of the water-table, and barometric pressure. The shocks are most common in September and least common in April.



Typical projectiles of field artillery and aircraft, shown in section.

Field Gun and Aerial Projectiles

Construction of Shrapnel, Smoke, and Searchlight Shells and Bombs for the Use of Aircraft

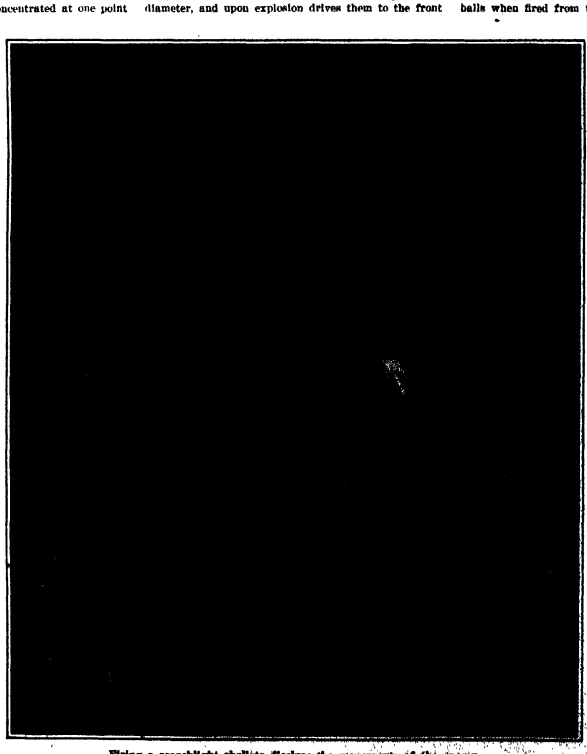
FROM the earliest days of artillery it has been found necessary to have one type of projectiles for the destruction of men and animals and another type for the attack of inanimate objects. In the first case only a small amount of energy is required to disable an individual, and the energy of an artillery projectile must be divided many times to make it efficient. In the latter case the entire energy concentrated at one point is usually none too great.

At the present time the common shrapnel which is separated into many smaller projectiles by explosion in the air, is the simplest for the attack upon animate targets and the high explosive shell which remains intact until impact is the typical projectile for the attack upon material objects. The fields of the two overlap to a small extent only and complications have been added by the necessity of having projectiles that are efficient against aircraft.

The construction of the common shrapnel, except that of the time fuse, is shown in Fig. 1. When the time fuse has burned the length of time for which set at the time of loading, a small magazine of powder in the fuse is ignited and the flame from this shoots down the central tube and explodes the black powder bursting charge in the base of the shrapnel. The case is made of a high grade of steel and does not break up at the time of explosion, but the entire contents and head are blown out to the front with increased velocity. The effect resembles suspending a huge shotgun in the air about one hundred yards in front of the enemy and firing it in that position. Each ball is intended to have sufficient energy to inflict a disabling wound, and effort is made to regulate the burst so that it will be in air and at a sufficient distance in front of the target to have an average distribution of balls of about one to the square yard of surface. In case of failure to burst in air the fuse is so arranged that explosion will take place on impact, but the small bursting charge causes little damage.

The light field guns of the various armies are of approximately 3-inch diameter of bore and fire projectiles weighing about 15 pounds. A shrapnel of this weight contains about 250 lead balls each ½ inch in diameter, and upon explosion drives them to the front with a velocity of about 300 feet per second, which must be added to the velocity with which the projectile was moving at the time of explosion. This increased velocity is of importance at extreme ranges, at which the projectile velocity may be as low as six or eight hundred feet per second. The matrix which is ignited upon explosion prevents deformation of the balls when fired from the gun, increases the visibility of burst and has considerable incendiary effect upon inflammable objects.

Fig. 2 shows a typical fuse used in the common shrapnel. As the projectile is driven down the bore the inertia of the concussion plunger causes it to slip through the resistance ring and strike the pin *E*, which explodes the concussion primer. The flame from the primer passes through *A* and ignites the fixed time train. To increase the length of the time train it is usually made in two parts, as shown, one of which is contained in a movable ring by turning which the time of burning is regulated. In the typical fuse the annular fixed train burns from the point of ignition hole *A*, until hole *B* in the movable train is reached. The movable train is then ignited through *B* and burns back to fixed hole *C*, communicating with magazine *F*. The greater the angular distance between hole *B* and hole *A* the longer the fuse will burn before explosion. By setting the movable ring so that *B* is opposite *A*, flame is at once permitted to pass through *B* and *C*, and the projectile is exploded within a few feet of the muzzle. The annular rings of time train composition do not form complete circles, and during transport a section of the blank space in the fixed circle is over hole *B*, so that in case of accidental ignition of the primer the flame cannot pass from the fixed to the movable train. A simple percussion or impact fuse is sometimes



Firing a searchlight shell to disclose the movements of the enemy.

...ing pin strikes the base fuse. In the typical fuse shown, *J* slips over *J* at the time ...ing pin *K*. Upon striking, ... is driven forward and pin *K* strikes ..., which ignites *F* by way of *D* ... which explodes the shrapnel. For ... bring the fuse in left set as for ...tion.

... fuses of the type described have ... developed and have excellent ... of burning, but, as one author... the method of measuring time ... a train of powder is about as ... principle as King Alfred's can... Clockwork fuses naturally sug... themselves as a solution, but the me... difficulties are great, owing to the ... carried in overcoming the inertia ... parts when fired from the gun. The ... force on a part weighing 100 ... may be as great as 300 pounds, and ... of a delicate part will result ... provision is made to support the ... during the period of acceleration.

A typical fuse of the clockwork type is shown in Fig. 3. *A* is the main spring under tension, *B* the main spindle, which is hollow, *C* the escapement, and *D* a train of gears. All of these parts are similar to those of an ordinary clock. *E* is a lever which must rotate with spindle *B*, but which can move forward under the force of spring *F*. *G* is a pawl which locks the clockwork and also lever *E* in the position shown. *H* is a cap which can be rotated to set the fuse at the desired time of bursting. The action is as follows: The inertia of pawl *G* causes it to move to the rear with respect to the other parts at the time of firing. This releases the clockwork and also permits spring *F* to push arm *E* against annular projection *I* of cap *H*. *E* rotates with spindle *B* for the time set, at the end of which it moves forward into notch *J*. This releases lever *E* from the restraint of annular projection *L* on *E*. *K* swings outward under the action of centrifugal force, rotating spindle *M*, thus releasing firing pin *N*, which is driven into primer *O* by spring *P*. The primer ignites powder *Q*, the flame from which passes down the central tube and explodes the base charge of the shrapnel. The percussion elements are similar in principle to those of the combination fuse previously described. When percussion firing is desired, cap *H* is so set that on firing *E* moves directly forward into notch *S*, locking the clockwork.

High explosive shell, as shown in cross section in Fig. 4, are used with light field guns for the attack of men behind the shields of field guns, small field works and such other objects as can be appreciably injured with a small charge of explosive. The larger calibers of mobile artillery intended for the destruction of permanent fortifications or strong field works use these shells almost exclusively. Few commercial explosives are suitable for shell fillers on account of being unable to withstand the shock of discharge, deteriorating in long storage, being hygroscopic, exuding nitroglycerine, reacting on the walls of projectiles, etc. Picric acid or its salts either alone or mixed with substances intended to make them less sensitive or to improve the chemical reaction on explosion are most commonly used. To this class belong English lyddite, Japanese shimose, and French melinite. The principal objection to picric acid is its tendency to form sensitive salts when in contact with metals, and care is therefore taken to keep it from the walls of the shells by protective coatings of asphaltum paints, *papier maché* cartons, etc. Trinitrotoluol, derived from certain by-products of the gas works, although less powerful than picric acid, is coming into common use, as it is an almost ideal explosive from a military standpoint. It is manufactured extensively in Germany and probably is being used largely by that country in the present war.

Shells are as a rule fused to burst on impact only. The firing pin of the detonating fuse is armed essentially as described for the percussion firing pin of the combination fuse. Upon impact the firing pin strikes a primer which detonates a small quantity of fulminate of mercury or other detonant, contained in the forward end of the fuse. This in turn detonates the high explosive bursting charge. In Fig. 4 *A* is the shell, *B* the high explosive, *C* the detonating fuse, *D* the copper rotating band, and *E* a copper base cover.

The necessity of carrying both shell and shrapnel and the impossibility of predicting the proper proportion has led to attempts to develop a compromise projectile which would perform the functions of both. This has resulted in the high explosive shrapnel, which has been quite generally adopted, and a type of which is shown in Fig. 5. The construction of the rear portion of this projectile is the same as that of the common shrapnel except that the matrix surrounding the balls is a substance, such as trinitrotoluol, which will merely burn when ignited by black powder, but which will act as a high explosive if a detonating fuse is exploded in contact with it. The head is larger than that of the common shrapnel and contains a small charge of high explosive, which in effect makes a small shell out of the head. The central tube is replaced for a portion of its length by the passage *A* in the wall of the head. The combination fuse is the same in principle as that shown in Fig. 2, except that the small magazine of black powder is replaced by a detonant. If it is desired to use the projectile as a shrapnel, the time fuse is set, and upon explosion of the base charge in air, the head and balls are driven out to the front. The explosive matrix merely burns and makes the point of burst more visible. The percussion elements of the combination fuse detonate the head on striking. The explosion of the head facilitates observation of fire, and under favorable conditions the fragments of the head are effective. When it is desired to secure the effect of a high explosive shell the fuse is not set. Upon impact the head detonates as explained above, and this detonation produces detonation of the matrix. The functions of certain other parts of the projectile shown are described in connection with projectiles for the attack of airships.

Aerial navigation led to the development of guns and projectiles intended especially for the attack of both heavier than air machines and balloons. Some of these were practicable, but for service with armies in the field, where transportation is rarely sufficient, it is impossible to provide ample armament for this purpose alone, and the practical solution has been to so modify the design of guns and projectiles in common use as to make them fairly efficient against aircraft without impairing their serviceability for other purposes.

Fig. 6 shows a projectile especially intended for the attack of balloons. At the instant of firing, primer *A* strikes pin *B*, exploding it, which ignites the large mass of incendiary material *C*. The smoke and flame from *C* pass to the air through vents *D D*, and enable the flight to be followed with the eye, which aids in adjusting the laying of subsequent shots. A sensitive percussion fuse *E* is provided, which upon impact with the slightest resisting substance, such as balloon fabric, will explode a bursting charge *F* which is sufficient to fragment the shell and seriously injure the parts near the explosion. In the case of a balloon the gas would probably be exploded by either the bursting charge or the burning tracer compound.

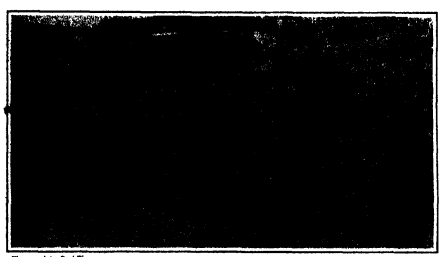
Fig. 5, in addition to illustrating the principles of the high explosive shrapnel, shows the modifications made in one type to render it more effective against aircraft. At *B* is a partial annular ring of inflammable material, resembling the time ring of a combination fuse. It is ignited by flame from the passage *A* at the time the base charge is exploded. As the head *C* continues its flight a trail of smoke is left by *B* and after a certain time *B* burns around to *D* and ignites the detonator *E*, which detonates the head. A quantity of smoke

(Concluded on page 480)



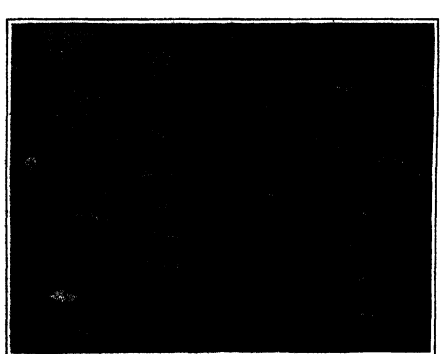
Photograph by Paul Thompson

Bombs designed to be dropped from aeroplanes and dirigibles.



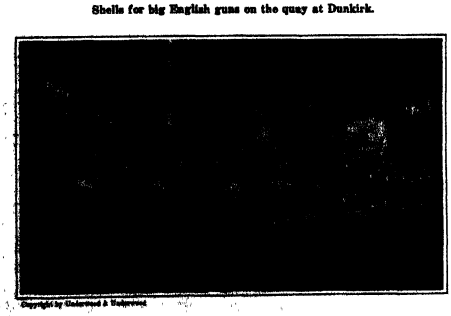
Photograph by Paul Thompson

Store of French ammunition found at the fortress of Longwy.



Photograph by Paul Thompson

Shells for big English guns on the quay at Dunkirk.



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Filling shrapnel shells with bullets.

Strategic Moves of the War

Letter from the Military Correspondent of the Scientific American, November 24th, 1914

The French Campaign.

THE war in Europe has now developed to a stage where the operations in Russia and in France are to some extent interdependent German activity in Russia means comparative inactivity in France. During the past ten days Germany has been making one of the greatest strategic moves of history. Few of the details are given out in the official bulletins, but they may be surmised to some extent from the known facts.

In the west the Germans found themselves unable to make headway against the French and British. In the east the campaign to the Vistula had failed, and the Russians were advancing triumphantly to the borders of Germany. Germany faced disaster if she continued her policy of attempting a powerful effort on both borders. She adopted, then, the policy of holding the western line with the smallest force possible, while launching the troops thus released in a new invasion of Russia.

The relative strength of the opposing forces in France and Belgium have been estimated by one authority as 1,800,000 Germans against 2,300,000 Allies. Another authority estimates them as 1,600,000 against 2,700,000. Whatever may be the exact figures, there is no question but that the Germans are very much inferior to the Allies in numbers in this theater of operations.

As the Germans seem to have still further increased this numerical discrepancy in this recent shift of forces, the question arises as to how they can do it without inviting disaster The decrease in numbers has necessarily caused a diminution in the energy of the German assaults, but for defensive fighting, which seems to be their present rôle in the western field, the Germans have a powerful auxiliary to supplement their lack of men.

The big development of this war has been the great improvement in artillery and in the supply service. Indeed, it is well named a machine-made war. Like any other machinery, the new highly developed types require fewer men, yet accomplish equal or even greater results.

Especially is this the case with the German machine gun, or automatic rifle, that has been quoted so often in the dispatches It fires the same cartridge as the rifle, but has them mounted in long bands from which they are fed into the gun. Its fire for short periods at the rate of five shots a second gives it great value in stopping charges or in shooting up any bodies of the enemy that expose themselves

The Germans have these guns posted so as to cover the ground over which attacks will probably be made. When the signal is received from the observing station that the enemy has reached the danger zone, the gun that covers this part of the front can then turn loose a storm of bullets that will wipe out any troops in its path. Ten men can in this way deliver as much fire with machine guns as can one hundred men with rifles.

Besides the advantage in machine guns, the Germans have so far had an additional advantage, in that their 6-inch siege guns could outrange most of the field guns of the French and British. But such equipment wears out rapidly in service; the bores get worn and the shooting is inaccurate; guns are captured; many are broken or destroyed. It is doubtful whether Germany can replace this great drain upon her equipment in spite of her great ordnance factories. The Allies, on the other hand, have not only their own gun works, which are working night and day, but they are also calling on most of the arms and ammunition factories of the world to aid in increasing their mechanical fighting equipment.

At present the Germans are counting on their superior equipment to enable them to hold back the western Allies while Germany and Austria prosecute their campaign against Russia The French and British have had to fight for time to complete the equipment of their armies. France now has nearly caught up with Germany; Great Britain, though far behind, is steadily gaining. The situation in France seems to point to an early assumption of the aggressive by the French and British.

Meanwhile the whole week of fighting in the western field has consisted of bombardment and minor attacks. Fighting was reported at Dixmude, Bixschoote, and Ypres in Belgium, and in France at La Bassée, Arras, Lihons, Tracy le Val, Vailly, Rheims, Ornes, Les Eparges, Chauvoncourt, Clrey, and Ste. Marie. Yet in no place has the battle line been moved more than two miles.

At Chauvoncourt, on the west bank of the Meuse immediately across from St. Mihiel, the Germans have maintained their position in spite of desperate efforts by the French to dislodge them. The French gained the outskirts of the town, but were blown up by mines that the Germans left behind them in retreating, and were driven back again with great loss.

The most noticeable feature of the week in the western fighting is the sudden change by the Germans to a defensive rôle, and the apparent refusal of the Allies to accept the challenge.

The Russian Campaign.

In Poland events have moved fast. On November 16th the German flying wedge had reached Kutno, sixty miles from Thorn. Overcoming the Russian resistance here, the Germans pressed forward along the railroad and reached Lowicz three days later. A further advance brought them within forty miles of Warsaw, but also found their way barred by the army that the Russians had rushed to this field.

This move of the Germans shows bold and able strategy. Their invasion is not aimed at the Polish capital itself, but is directed at severing the main supply lines of the Russian armies in southwest Poland. Such a success would leave the Russians no choice but to make a rapid retreat toward the Vistula, with a weakening of control that might give the Germans a chance to get in some telling blows.

The Russian commander is also a strategist of demonstrated ability. The retreat of the Russians before the first onslaught of the Germans was undoubtedly planned to draw the latter further from their railroads and thus to improve the Russian chances. However, the Russian retreat beyond the Bzura brings their forces to the south into such great danger, that it seems to have been forced by the suddenness of the advance of the Germans in unexpected strength.

The threatening move of the Germans against the right flank of the Russian army in Poland has been accompanied by a similar effort made by the Austrians against the Russian left flank. The abandonment of Galicia has enabled the Austrians to concentrate a strong army in the vicinity of Cracow. During the last week they have been making vigorous efforts to break through the Russian resistance along the railroad, twenty-five miles north of Cracow. On this flank the Russians have held firm. Their center is now able to pivot about this southern wing to fall back to a less exposed position. No news has been given out about the operations on this part of the line, but the safety of the Russian's center would seem to dictate its retreat to a line through Lodz and Plotrkow.

While endeavoring to stop the German invasion on the lower Vistula, the Russians are at the same time making an advance in Galicia that is threatening the Austrian right flank. By the capture of Neu Sandec on November 22nd the Russians gained the whole line of the Danojec River and deprived the Austrians of an important railroad leading into Hungary. The Russian occupation of Galicia is now complete except for the fortress of Przemysl and the district surrounding Cracow. The advance of Cossack divisions through the passes in the Carpathians may soon result in new raids into Hungary similar to those of September last.

In East Prussia the Germans have held the Russians to the line of the Angerapp River, thirty miles west of the border. Both sides in this fighting seem to have had their forces drawn upon heavily to reinforce the armies in Poland. Consequently, the fighting in this field is now a subordinate phase of the war. There seems to be a cessation of activities on both sides while waiting for the outcome of the decisive battle west of Warsaw.

The Turkish Situation.

The raiding force that Russia sent into Armenia on the outbreak of hostilities with Turkey proves to have consisted of about one corps of infantry and two divisions of cavalry. At Koprukeui, half way between the border and Erzerum, the Russians were checked by a superior force of Turks and were driven back to their own territory. The fighting since then has consisted of minor skirmishes along the border. Along the Black Sea coast the Turks have been pushing forward into Russian territory and now claim to have reached the Chorok River, fifteen miles from the border. All of this fighting amounts to little more than maintaining as compared with the great battles taking place in Europe.

In Egypt the Turks have crossed the border and have invaded the Sinai Peninsula. By the capture of Katasa and Teatebe, twenty miles from the Suez Canal, they force Great Britain to make an active effort in protection of her line of communications with India. They now claim to have reached the Canal at El Cantara. The thoroughness of the censorship concerning news from Egypt and Suez suggests that the British consider their forces there in a rather critical position.

The results of the week of the war are, on the whole, favorable to the Allies. They have suffered no serious reverse and have gained a week in the completion of the equipping of their armies that is a powerful factor to more aggressive operations.

Responsibility of Science for Eugenics

WITH the increasing density of population and the corresponding difficulties in securing [illegible] series of life, the struggle for existence between [illegible] communities and individuals is steadily becoming more intense, and this condition of affairs is attracting attention to the great numbers of defective and degenerate individuals among our population. How far the multiplication of this class in the past is due to ill-considered and mis-directed public opinion, and the [illegible] of science in the future, is commented on by Prof. [illegible] Bateson in his address before the British Association at its meeting in Australia, as follows:

The powers of science to preserve the defective are now enormous. Every year these powers increase. This course of action must reach a limit. Further ameliorate intervention of civilisation for the preservation of inferior strains there must sooner or later come an end, and before long nations will realise the responsibility they have assumed in multiplying these "workers of a calm world and a long peace." The sterilising of feeble-minded we may with propriety restrain, as we are beginning to do even in England, and we may safely prevent unions in which both parties are defective, for the evidence shows that as a rule such marriages, though often prolific, commonly produce no normal children at all. The union of such sociál vermin we should no more permit than we would allow parasites to breed on our own bodies. Further than that in restraint of marriage we ought not to go—not [illegible] not yet. Something, too, may be done by a reform of medical ethics. Medical students are taught that it is their duty to prolong life at whatever cost in suffering. This may have been right when diagnosis was uncertain, and interference usually of small effect; but deliberately to interfere now for the preservation of an infant so gravely diseased that it can never be happy or come to any good is very like wanton cruelty. In private, few men defend such interference. Most who have seen these cases lingering on agree that the system is deplorable, but ask where can any line be drawn. The biologist would reply that in all ages such definitions have been made by civilised communities, with fair success, both in regard to crime and in the closely analogous case of lunacy. The real reason why these things are done is because the world collectively cherishes occult views of the nature of life, because the facts are realised by few, and because between the legal mind—to which society has become accustomed to defer—and the seeing eye there is such physiological antithesis that hardly can they be combined in the same body. So soon as scientific knowledge becomes common property, views more reasonable, and, I may add, more humane, are likely to prevail.

How Big is the 42-centimeter Shell?

WITHOUT question the most astonishing development of the present war is the great 42-centimeter gun, which has enabled the German army to smash its way through fortifications hitherto believed to be impregnable. But just how big is the missile that has rendered fixed fortifications obsolete? The question has been with us ever since we heard of the fall of Liège and Namur. Of course it is easy enough to figure that 42 centimeters is equivalent to about 16½ inches; but this is merely one dimension, and, after all, mere figures are apt to be quite meaningless.

In order to give our readers some conception of the enormous size of the shell, we have prepared, as a supplement to the present issue, a life-size drawing of it. We believe that even the man who has taken the trouble to measure off 16½ inches with a tape-line, in order that he might form a mental image of the giant missile, will be awed at the mammoth proportions of the shell when he views its full-sized reproduction.

Motor Transportation in the War.

The motor vehicles at the front are of all sorts and sizes, and, although their services have been invaluable, the great variety of ideas and makes has developed disadvantages. In a transport line the slowest car sets the pace, and this has proved a cause of delay. On the other hand, the smooth level roads often met with on the Continent tempt the drivers of the faster machines to let them run, with the result that the heavily loaded ones very soon shake to pieces.

Correspondence

[We do not hold ourselves responsible for statements made by our correspondents. Anonymous communications will receive no attention. Name and address of correspondent must accompany letter, not necessarily for publication, but as a guarantee of good faith. We cannot undertake to return rejected communications, nor to preserve them more than a reasonable time unless specially requested to do so.]

A Parasitic Sunflower

To the Editor of the SCIENTIFIC AMERICAN:

In the garden of one of the residents of this city there has been during the past season a natural curiosity which would not be believed possible by many, unless upon the evidence of their own eyes. This is a grape vine, one branch of which is a sunflower. The sunflower leaves the main stem of the vine only about six inches from the ground, and a short distance up divides into two branches. Each of these branches bore a fully matured flower of the ordinary size and appearance.

To the casual observer, it appears that this strange freak has been brought about by the transformation of the grape vine into a sunflower, but such is not the case. A careful inspection serves to disclose the fact that at the point where the sunflower originates, there was a decayed place in the vine, into which, evidently, a stray sunflower seed found its way. As it developed, the sunflower stem filled this cavity, giving it the appearance of a genuine branch of the vine. The sunflower appears to have thrived in its strange habitat about as well as in its natural environment, and the grape vine was not injured by the parasite.

Mount Carmel, Ill. D. E. KEEN.

The Problem of Our Merchant Marine

To the Editor of the SCIENTIFIC AMERICAN:

The three articles appearing in the issues of SCIENTIFIC AMERICAN of recent dates, headed "Our Merchant Marine," are interesting from an historical standpoint, but rather pessimistic as to the beneficial results that may accrue to the United States and its citizens generally from the passage of the free ship bill recently enacted into law.

Those who have not pinned their faith on subsidy alone as a means of revitalizing our merchant shipping in the deep-sea trade are not particularly moved by the fears of those who have always advocated subsidy only as a means whereby we would again take our old-time place among the deep-sea shipping nations of the world.

As an instance of what seems a fallacious illustration: The author asks if our "nation could have saved itself in 1855-1860 by the purchase of 'free ships' from British yards," and goes on to ask "if any sane person believes that the mere purchase of a British steamship would make it possible to run that steamship profitably in competition with the Cunard Line, which was then receiving a subsidy of nearly $900,000 a year from the British government.

As to what might have happened if something had been done in 1855-1860 which was not done in behalf of shipping is merely guesswork. But we do know what has happened since 1891 and is still happening in the shipping transatlantic world.

The United States pays subsidies, called mail subventions, and has since 1891. The American Line with its four steamers referred to by the author has been drawing a subsidy from the United States since 1891 or thereabout; it amounts to approximately $700,000 annually. It was supposed that this act would greatly stimulate ship owning and operation in United States shipping, but the American Line never added a steamer built in the United States to the fleet with which it started out, so we might gather from such an experience that a mail subvention act if in effect in the United States in 1855-1860 would not have enabled an American steamship company to compete in foreign trade with the Cunard Line or British lines any more successfully than they are in these days.

Much has been made of the fact that there is no American shipping to carry our grain and cotton and other products to Europe; but our grain and cotton are shipped, nevertheless, and the freights go to enrich the owners of foreign-built ships, many of whom are Americans, who far reasons of profit preferred to operate under a foreign flag than under the flag of the United States, and continued so to do even after the passage of the Panama act, which gave the American owners of foreign-built craft, if not over five years old, the right to register them under the laws of Uncle Sam, and according to the author of the article, "Our Merchant Marine," not one of the foreign ships owned by Americans applied for American registration under this act.

The author exclaims against the West and South as being opposed to subsidy; he criticises the West and South for not expressing their willingness to be taxed in favor of a special industry which gave no evidence of giving better service or lower ocean rates; and this with the knowledge that the Government of the United States is paying out heavy subsidies to various lines under the Mail Act of 1891 and for which the West and South contribute their share.

Our coastwise shipping is pointed out as a resulting justification of the prohibitive navigation laws which conserve the coastwise trade of the United States to ships built in our domestic yards; whether such a law, going to the extreme of absolutely shutting out foreign-built ships—not allowing them to be entered under our laws and engage in coastwise trade subject to a duty—is wise is a subject of grave doubt, and the more so as Great Britain imposes no such restrictions; foreign-built or foreign-owned ships may engage in her coastwise trade on the same terms as British-owned and built craft.

But our navigation laws have been in effect for a hundred years or more and our coastwise shipping came into being under them; such ships are of high cost as compared with the foreign built, and when it was proposed at the beginning of the European war to allow foreign-built tonnage to engage in our coastwise trade, a sturdy opposition was manifested and the proposition was dropped.

It is felt that a grave injustice would be done to our American shipowners and investors, who paid a protective price for their ships, to allow foreign-built steamers to engage coastwise; there would be but one end to such a competition; the more cheaply built foreign tonnage would eventually drive the higher priced American-built out of existence.

But while the question has been disposed of for the present, like Banquo's ghost, it will not down. The question exists as to why it costs more to build steamers in the United States than they can be built for abroad, while we produce steel and iron in greater quantities than any other two nations put together and ship our steel and iron all over the world in competition with and to almost every nation.

Labor cost is given as one of the reasons for the high cost of building ships in United States yards, but the fact that automobiles and locomotives and every kind of machinery which employs as highly skilled labor as is employed in shipbuilding, are exported, while we never export a ship or build one for foreign trade, does not seem conclusive as to the cost of labor being the reason altogether for our inability to compete with the foreign shipbuilder.

Examples of what the Mail Act of 1891 has accomplished are given: The Ward Line, the Red D Line, and the Oceanic Line are cited as a satisfactory showing for what this act has accomplished in the twenty-odd years of its existence; a rather pitiful showing it makes contrasted with what the free ship bill passed a couple of months ago brought about. Up to October 20th, seventy-four foreign-built steamers, of 266,373 gross tons, were registered under the American flag, and the end is not yet.

The freight money paid these vessels will come here and most of it will stay in this country; the American flag will be seen as it used to be, in every sea; trade may or may not follow the flag, but where the flag goes there is trade; there is evidence now that the United States is a deep-sea shipping nation; merchants of other countries will have a new respect for the United States. The ship of itself increases trade between the United States and other nations; its disbursements are of no inconsiderable amount, and the prestige of the United States is increased by the display of its ships and their disbursements in foreign ports; every nation welcomes shipping to its ports; ours as well as that of other nations.

Doubt is expressed as to the permanency of this American registration of foreign-built ships; fears are felt in some quarters that when the war is over, they will again return to foreign registration; the expense of operation under the American flag, even though the permission to engage foreign sailors is granted, and in support of that view the instance is cited that the wages of one of the U. S. Steel Corporation steamers were advanced from $282 per month to $420; this would make an added expense to the vessel of some $1,656 a year registered as an American vessel over what she would have to pay if she were operated under a foreign flag. Well, a steamer of 5,000 tons costs abroad less than $200,000, so the added expense would amount to less than 1 per cent. An item, to be sure, but it would seem that a difference of not more than this might be overcome by American owners.

There are other factors that figure in the future development of shipping under the American flag induced by this European war; it is questionable if foreign governments can continue to pay subsidies and bounties in the future to their shipping on the same liberal scale as now; manufacturing across the water is disrupted; material will cost more; the burden of taxation will be greatly increased in Europe; in many of the European countries bounties are paid to coal and iron companies; it is doubtful if they can or will be continued; if they cease, costs for these articles will increase, and the power of European competition with our producers lessened.

These are factors that should be taken into consideration in estimating the permanency of our free ship policy; as a policy it is a stimulant to our trade and our imagination; we really are, at last, a nation with a deep-sea merchant marine; it is true that the tonnage placed under our flag is practically freighting tonnage, but that is a most important element in our shipping and trade development. We need not stop there, however, nor will we. We want fast passenger and freight boats; we want mail carriers; we want to bring foreign nations, the South American nations, close to our doors through the medium of *our* ships; we want to be, and need to be, at the head of the shipping nations of the world; our trade justifies it, our needs demand it; and as all free-ship nations pay subsidy for the development of shipping on special lines and in special trades, there would seem to be no good reason why the United States should not do likewise; there is one thing certain, fast steamers in regular lines cannot operate successfully under the American flag when they have to compete with the subsidized lines of foreign countries; we have not reached that stage where private ownership of steamship lines operated under the American flag can compete with the government-aided lines of Europe; they do not have to; the Mail Subvention Act is still in effect; there is nothing to stop the expansion of shipping under our flag; liberal payments are provided for ships operating under this act; it is pointed out that it has worked successfully in the West Indian and Venezuelan trade; the American Line operates under it to Southampton, or did till the war started, why should it not be taken advantage of, to a far greater extent?

After the war is over there is expected to be a vast emigration movement to this country; what preparations are American shipping lines making to share in this traffic?

Much is made of the differential duty that applied to goods brought in in the early days of the Republic; we have the differential duty now, though not yet in force; but times and conditions change, and it is doubtful if the differential duty would add to any great extent in upbuilding shipping under the American flag to-day. The great lines of freighting imported now are on the free list; ore, wool, hides, meats, lumber, fish, corn, and wheat pay no duty, and so there is no financial inducement to use an American steamer in preference to a foreign in such lines of freighting, leaving out of consideration the commercial treaties that cover the treatment to be accorded vessels of the United States and those of the countries with which the United States has treaties.

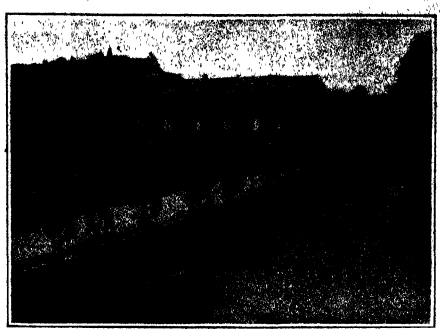
There are two great forces now in effect that should aid the enterprise of Americans in shipping—free ships and the Mail Subvention Act; shipping is one of the greatest factors affecting the commercial welfare of nations; the financial feature of it makes it one of the greatest of industries; it has been charged that no mention is made of the profits arising from it by the foreign companies engaged in shipping, but it can be stated that the financial columns of our papers give a summary of the earnings and dividends paid by the most important of the transatlantic lines, but make little, if any, mention of what our coastwise earn or pay; with the greater interest now taken in shipping and its development we may expect the growth of a wider knowledge of the shipping industry of the United States, and with the interest of the public awakened to the fact that in shipping there is a great field for investment; that we have now a great fleet of steamers operating under the American flag; that the Government is in position to aid shipping under the Mail Subvention Act, still in effect; it is to be hoped that some of the energy spent in seeking subsidies will be devoted to development of American shipping under the favoring conditions now ruling.

If the present Government aid is proven to be still insufficient to bring about the results in which the country generally is interested, to place the United States among the very first of shipping nations, then it can readily be determined what further steps need be taken to bring it about.

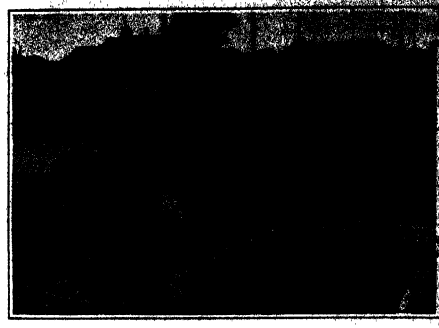
In the meantime, the conditions ruling give us the opportunity to secure a place in the shipping trade of the world that has not existed since the birth of the country. Will we have the courage to take advantage of it?

CHARLES DEERSE.

To Knight Aerial Fighters.—The well-known English writer, H. G. Wells, wants to have the aerial fighters of the British army knighted, and this is the way he puts it: "Every aviator who goes up to fight—I do not mean to reconnoiter, but to fight—will fight all the more gladly with two kindred alternatives in his mind: a knighthood or the prompt payment of a generous life-insurance policy to his people. Every man who goes up and destroys either an aeroplane or a Zeppelin in the air should, I hold, have a knighthood if he gets down alive; and I venture to say that we shall create thereby the most honorable and enviable order that this world has ever seen."



French ponton bridge thrown across the Marne at Lagny in three hours.



Building a large ponton bridge over the Marne.

Building Bridges Under Fire

One of the Most Difficult and Spectacular of Army Operations

By Martin Wells

MORE than once the success or failure of a campaign has depended upon the successful passage of a river, a barrier of flowing water to further advance. Held strongly by an enemy on the far bank, the offensive movement of a greatly superior force has been checked so thoroughly that a strategic victory has resulted for the lesser arms and the strength of an invader rendered impotent

From these lessons of military history, definite procedure for pontooneers has been evolved. The various parts of material which go to make up a bridge train have been tested and re-tested Every expedient has been resorted to, to make weight as little as is consistent with strength and adequate service, while an organization has been completed, in every army of the civilized world, with minute attention to detail, to make the ponton bridge service so efficient that no chance of an upsetting of plans could come about. Every detail has been looked into and provided for.

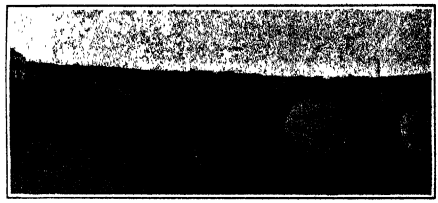
In these days of general staffs, it is safe to make the statement that the territory of each country which may become a possible theater of war is thoroughly mapped out and the maps filed away in the steel cases of some war college Not only is the terrain plotted, but the physical resources of each country are accurately estimated, that an invading army may know where to lessen the amount of supplies of certain kinds to be forwarded by the line of communication service, by knowing what may be secured in the country itself

From the maps and this data each possible campaign is forecast in minute detail During the piping days of peace, the staff classes devote hours a day to working out these details, and when they are completed and approved, the plans are filed away, to be unearthed upon the approach of war or altered, to post to date.

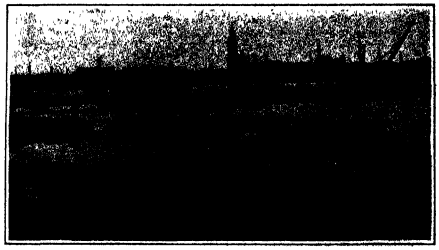
In these plans the bridge trains are considered The maps show where the rivers are The science of war predicts where a wise enemy will have destroyed his permanent bridges, and the plans of the general staff, ever seeking to make the line of communication and transport columns as light as possible, call for the dispatching of bridge trains to proper points at the proper time

As used to-day, the ponton bridge is scarcely a century old, yet it has been used in warfare, in some lesser form, almost since there was war by forces with any pretense of organization In the early days of Britain, the tousel-headed savages used, as a river-crossing expedient, the skins of animals, inflated, tied, and bound together, to form rough rafts, on which the wild soldiery effected a passage. And at exactly the same time, the legions of Rome used the same method, supplemented by the craft of commerce.

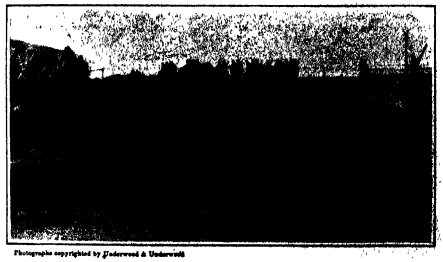
Most of the lessons which are applied to pontooneering to-day come directly from the American civil war. During those horrid days, when the soldiers of a divided nation clawed at one anothers' throats, the science of pontooneering was developed to its highest phase, and the use of bridge trains was so constant, that foreign observers gave particular attention to the way in which the problems were worked out in warfare, and the present almost universal system has resulted.



Bridge at Huy blown up by Belgians and repaired by Germans.



Belgians building a ponton bridge across the Scheldt at Antwerp.



Photographs copyrighted by Underwood & Underwood

Bridge over the Scheldt destroyed by Germans and repaired by Belgians.

One of the greatest lessons of the service has carried the conviction that a ponton bridge may not be thrown across a river held by the enemy, in daylight, unless under cover of a fog. Time and again it was tried during the Civil War, and disaster always resulted. The attempt at Fredericksburg, by Burnside, to force the Rappahannock in the face of the Confederate fire, a mere handful of Barksdale's sharpshooters, was such a hopeless failure, that, pressing as the necessity for crossing was, the plan was abandoned until the fall of night.

In any case, losses must be sustained, so the lesser evil has been chosen. In modern times, when it is of paramount necessity that a river be crossed by daylight, in the face of an enemy, the pontons are used as bateaux, and detachments are ferried across at the safest points to clear the opposing troops away, while the friendly artillery endeavors to cover the ferriage. When the opposite bank is once held, in spite of the enemy's fire the erection of the bridge may usually proceed.

The situation depicted on the cover page represents a surprise attack upon a party of pontooniers from a masked battery, and not an attempt to put a bridge across a stream in the face of shrapnel fire.

There is little difference between the bridge trains of various powers, except in minor details. The broad principle is the same, and since the modern ponton bridge is mainly based upon the American method, it is better to discuss that merely.

Bridge trains are divided into two classes, the heavy and the light, sometimes called reserve and advance guard trains. The boats and material of the advance train are much lighter than those of the reserve, for the boats are a mere knockdown framework over which canvas is stretched to form the buoyant float. Mobility is the watchword of the advance guard trains, for they must be able to rush ahead with independent cavalry, sometimes three days' march in advance of the main body.

The very lightness of construction of these trains has its drawbacks, for the frail canvas covering has not the strength to stand the battering of an ice-choked river or the constant strain of a contin-

upon them of construction. In addition, a number of rafts, more nearly than any of the pontoons, are kept in reserve, these rafts being constructed of the same timbers as comprise the bridge. By means of the massive pontoons, or rafts, and by conversion, in the first case, each pontoon is put in place from one or both banks, and the ends of the roadway completed in turn. By parts, sections of the bridge are built along the bank, floated to position, and the smooth, unbroken roadway filled in, with all the boats of the bridge an equal distance apart. By rafts, the pontoon sections, consisting of five or six pontoons, with roadway, are constructed at the bank, floated to position, and the end bays of each raft are lashed to the end boats of the adjoining rafts, with the roadway completed by false balks and roadway over the joint. The method by conversion is the hardest of all, for with it the pontoniers must be thoroughly experienced men and know their business. Even the carelessness of one man, in casting an anchor at the wrong place, may upset the entire scheme and nullify the operation. In conversion, the entire bridge is built along one bank, an end secured, and the entire bridge is then permitted to swing out on the current until, pivoting at the near bank, the bridge is swung into position across the river, when the abutment bays of the roadway are laid.

This method of pontooneering was employed by Napoleon when he made his way against the Austrians from the island of Lobau. A great French engineer conceived the plan and referred it to his Emperor, who adopted it on the spot as the means by which to make a sudden and unexpected crossing. Had the successive pontoon system been employed, the enemy would have had ample notice, but as the time required was but sufficient for the bridge to swing into position, it lent itself to the unexpected, upon which the attack was founded.

The method of constructing by successive pontoons is the one usually employed when the stream is not too broad. Assuming that a force of an enemy holds an opposite bank and that it is necessary to dislodge him and cross, the method of procedure is about as follows:

Under the protection of rifle and artillery fire, the ponton wagons are brought as close to the bank as shelter permits, when the pontooneers, aided by details of infantry, lift the boats from their wagons and transport them by hand, at a run, to the edge of the water, then launch them.

Accompanying them, the infantry details which are to make the crossing in the attempt to dislodge the enemy, come up on the run and file into the boats, where the pontooneers already man the oars. The infantrymen take seats alternately, right and left, so as not to disturb the equilibrium of the boat, and as soon as it has its quota of men, the boat pushes off for the opposite bank, while the friendly forces redouble their efforts to keep down the enemy's fire. As under no conditions must the stability of the boat be upset, stringent orders are issued that no attempt at rendering assistance to a stricken comrade must be made, and that no shot is to be fired from the boat.

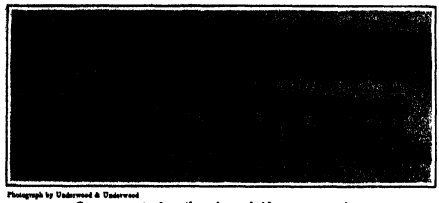
When the boat finally grounds on the opposite bank, the survivors spring out and rush the bank. Probably the entire bridge train has been employed in the ferriage, so a fair number of men can probably be landed on the far shore. These men take up the task of clearing out the enemy, while the pontons return at once to the other shore to begin the construction of the bridge.

A shallow trench has been dug in the bank and a sill laid, for the security of the abutment span. The first ponton is anchored in position, the length of the span away from the bank, and the balks or stringers are laid in the notches. Receiving from the shore, the waiting pontooners rush forward with the flooring, the apron, as it is called, to be followed



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British pontooniers rowing a ponton into position.

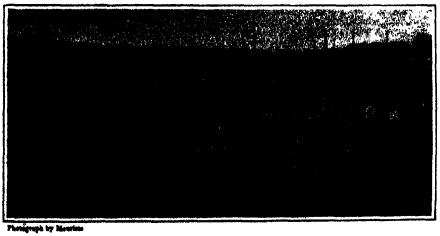


Photograph by Underwood & Underwood

German pontoniers throwing a bridge across a river.



Austrian army engineers at work on a ponton bridge.



Photograph by Moreau

Convoy of Spahis crossing a ponton bridge at Compiegne.



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Scottish troops crossing a bridge built by British engineers.

by the bearers of the side rails, which are securely fastened with rack-lashings. By the time the first span is laid, the second ponton is in position, and the work continues until the bridge is completed. Each ponton is securely anchored with an upstream anchor, while every other one, at least, is secured by a down-stream anchor, in addition. Spare pontons and rafts are anchored above the bridge, ready to be floated into position in case of accident, such as the striking of a destructive shell.

By the time the end of the bridge is nearing the opposite bank, the troops which are to cross are approaching the initial point, the entrance to the bridge, where engineer and staff officers keep careful watch to see that there is no crowding. The commanding officer of each column has been told almost the exact second when his command should enter the bridge, and he has his troops under way at the proper time, to prevent any massing of troops about the approach.

Infantry is required to break step in crossing, for the rhythmic beat of marching feet would soon set up such a swaying of the bridge that the anchors would be broken out and the bridge racked to pieces in a few moments. Cavalry and artillery dismount and lead the horses across. Troops and carriages are required to keep certain distances apart, to prevent the concentration of weight upon any part of the bridge, and men are stationed along the length of the bridge to see that there is no crowding.

In case of accident, when there is time or material, one or more boats are posted below the bridge to assist in the rescue of any who may be precipitated into the water, by the enemy's fire or otherwise.

The ponton trains are so small in comparison with the combatant forces of an army that they receive little attention from the general public. As a matter of fact, the service is about as spectacular and dangerous a one as exists, one that calls for cold nerve and judgment, and it is a service so important, that at times the fate of a nation may hang upon a perfect functioning.

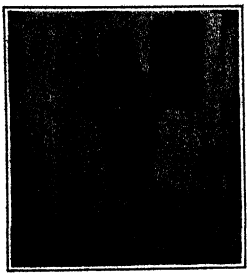
In peace, the engineers are constantly drilling with their bridge trains, using every method and throwing their swaying structures across different waters, in the effort to perfect themselves against the time of need when their drilling may be necessary under the grueling fire of a determined enemy. It is a great service, and the engineers and pontooniers rather pride themselves upon their unobtrusiveness, yet glory in efficiency. Their motto, "*essayons*," "let us try," is an epitome of their spirit.

Making Mirrors by Electricity

A RAPID and admirable method for depositing suitable metals on the surface of glass so as to produce mirrors consists of decomposing the metal by means of a high potential electric current. It is thus described in the *Physikalische Zeitschrift* by G. Rumelin.

A metal plate is placed in juxtaposition with the glass plate which is to receive the coating. The two plates are then placed flat on a table beneath the receiver of an air-pump suitable for producing a high degree of vacuum, such, for example, as the rotary pump of Gaede. A small quantity of an inert gas, such as hydrogen, is introduced into the vacuum and a high potential current is then turned on by means of the negative pole of a suitable source of electricity, this pole being attached to the metal plate. Thirty seconds duration of this cathodic flow is sufficient to obtain a properly silvered mirror. Besides silver the metals gold, copper, platinum, nickel, iron, palladium, and iridium may be employed.

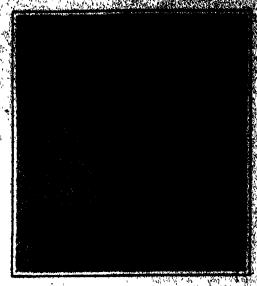
A Novel Advertising Sign.—In patent No. 1,096,088 Gridley Adams of New Rochelle, N. Y., shows an advertising sign in the way of a concrete embodiment of the "parallax of motion," and in which the illusion of motion in an automobile representation is sought to be effective.



Djémal Pacha, Turkish Minister of Marine.

The Military Resources of Turkey, the Latest Country to Enter the Great World War

An Army of Proved Fighting Ability—A Navy Which Has Yet to Win Its Laurels



Enver Pacha, Turkish Minister of War.

THERE is probably no army regarding which it is more difficult to make any definite statement of strength than that of Turkey The estimates of the total number of men, fully armed and equipped, that Turkey can put in the field vary all the way from over 1,200,000 to 500,000, the latter being the estimate of certain military men in the United States Army, whose opportunities for gathering information on this subject are unusually favorable.

In 1910 there was undertaken a revision of the whole military system, and at that time the term of service was 20 years from the age of 20 to the age of 40 for all Ottoman subjects. Formerly Christian subjects of the Ottoman Empire were exempt, but had to pay an exoneration tax; to-day, unless a change has recently been made, Christians are subject to service.

In 1910 the total war strength of the infantry was given as about 1,150,000 rifles, with other troops in proportion, but it is quite unlikely that such a force existed anywhere but on paper

When the war broke out, the reorganization and re-equipping of the Ottoman army under the German general, Von der Goltz, was under way, but far from complete; and there is no doubt that the sudden declaration of war by the Balkan States found the Turks at a disadvantage of unpreparedness, comparable to that of the French when the German troops poured across the neutral lands of Belgium

The crushing series of defeats of the Turks wrought havoc in their army Some of the best regiments were all but annihilated, a vast amount of artillery and general equipment was captured or destroyed, and, worst of all, a serious blow was struck at the *morale* and prestige of the whole army

In the interval since that war, the government, with German assistance, has been carrying on the reorganization. How far this has progressed, and just what is the effective strength, it is difficult to say. Judging from dispatches from Constantinople, there has been a large influx of Germans among the officers, especially in the higher commands, and it is believed that the artillery has been strengthened by the importation of field guns and howitzers from Germany

Advices from Constantinople are confusing and contradictory; but it is known that all men between 18 and 45 have been called out. A levy in mass is, apparently, being tried; and there are races in Turkey, the Arabs of Arabia, for instance, who under favorable conditions, would be somewhat formidable.

How many men could be enrolled is dependent upon data which is rather vague. It depends not merely upon the total population, but upon the popularity of the war and the degree of control of the Stamboul government. That control is very little felt in Arabia and among the Kurds of Armenia.

It is not believed that the declaration of a holy war will have the far-reaching effects that have been popularly supposed. Its influence will probably be confined to such tribes as those above mentioned. It is not believed that it will lead to practical results among the huge Mohammedan populations that are subject to Great Britain and France.

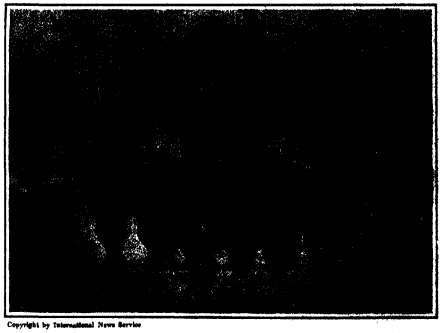
The Turkish infantry is armed with the Mauser rifle (model 1887 and 1890), of which there are said to be over 1,000,000 issued and in store. There are, or recently were, over 500,000 Martini-Henry rifles in reserve.

The strength of the Turks in artillery is not known with any accuracy. Ten years ago there were 1,188 guns in the field batteries, 108 in the horse batteries, 240 in the mountain batteries, and 72 guns in the howitzer batteries. The field gun is of the Krupp pattern, the howitzer of the Schneider pattern, with some Krupps.

The Turk, when properly officered, is a redoubtable fighter; and we say this in spite of his overwhelming defeats in the Balkan war; for in that struggle he was taken unawares, and the leadership was poor. Under German guidance at headquarters and German control in the field, he will undoubtedly give a good account of himself in the present war, in which his chief handicap will be his numerical inferiority to his Russian enemy. For it is the opinion of the best informed military men in this country that if the Stamboul government places 600,000 well equipped regular troops in the field, that figure will represent its maximum effort.



Turkish field gun on the march.

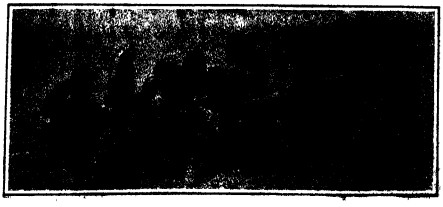


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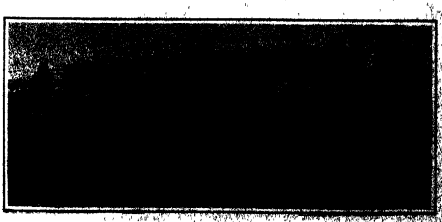
Turkish infantry in their new uniforms and cloth-covered helmets.

The Turkish Navy.

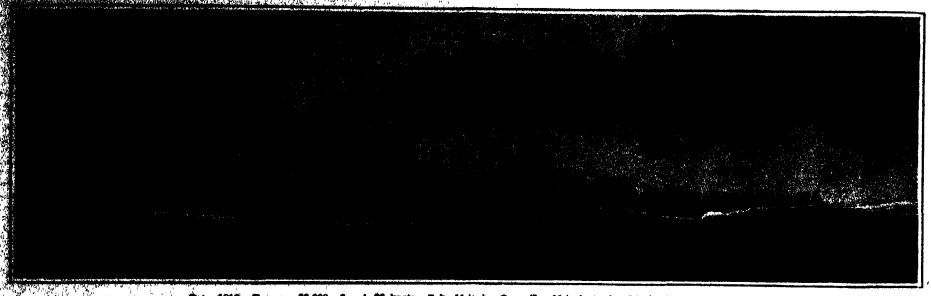
Until the year 1910, when Germany was engaged in the reorganization of the Turkish army, the Turkish navy was a negligible quantity, such ships as it possessed being in the main old, ill-manned and in poor repair. In 1910 the Turks acquired by purchase from Germany two of the older battleships of that power, the "Kurfurst Friedrich Wilhelm" and the "Weissenburg," of one of which we present an illustration. These ships were laid down respectively at Wilhelmshaven and Stettin in the year 1891. They are of 10,000 tons displacement and 17 knots speed. They are protected by a belt of 15¾ inches of the old compound armor, with 11¾ inches on the gun position. They are armed with four 11-inch, 40-caliber guns and two 11-inch, 35-caliber guns, carried in three barbettes, the guns themselves being protected with 5-inch gun shields. One pair of guns is mounted forward on the forecastle deck, one amidships on the main deck and one on the main deck aft of the mainmast. The torpedo defense battery consists of eight 4-inch guns mounted in a central battery protected with 3 inches of armor. The ships were built at a time when the necessity of lofty freeboard and high command for the guns was not fully recognized, the freeboard forward being about 19 feet and aft about 12 feet. In smooth water, and at not too great a bat-



A mountain battery in action.



Company at rifle drill.



Date, 1912. Tonnage, 32,000. Speed, 26 knots. Belt, 11-inch. Guns: Ten 11-inch, twelve 6-inch Torpedo tubes, 4.

Former German battleship "Goeben," now flying the Turkish flag.

long-range and with good gunnery, these two old battleships should be fairly effective, even to-day. In rough weather, and if opposed to modern ships with the latest types of gun, they would be hopelessly outclassed.

At the outbreak of the war, two of the most powerful battleships afloat were completing in British yards; one, the "Sultan Osman I," formerly the "Rio de Janeiro," commenced for Brazil, and the other, the "Sultan Mehmet Reshard V," built directly for the Turkish navy. The former mounts fourteen 12-inch guns and twenty 6-inch; the latter ten 13.5-inch and sixteen 6-inch. These two vessels were, of course, taken into the British navy on the declaration of war. The loss to Turkey was partially made good by the Germans, when the battle-cruiser "Moltke" and the scout-cruiser "Breslau" took refuge in the Dardanelles. It was reported that these two ships were sold to Turkey. Their German officers and crews remained aboard, apparently awaiting the developments which were shortly to come. When Turkey entered into the war these ships became immediately active as part of the Turkish fleet.

The "Moltke" alone, with her powerful battery of ten 11-inch, 50-caliber guns, and twelve 6-inch; her excellent protection of an 11-inch belt, and her high speed of 28 knots, is worth more to Turkey than the whole of the rest of her navy. The "Breslau," moreover, of 4,550 tons and 28 knots, protected with a 3½-inch belt and mounting twelve 4-inch guns, is worth more to Turkey in the work of commerce destroying than the two or three protected cruisers which she possessed when the war opened.

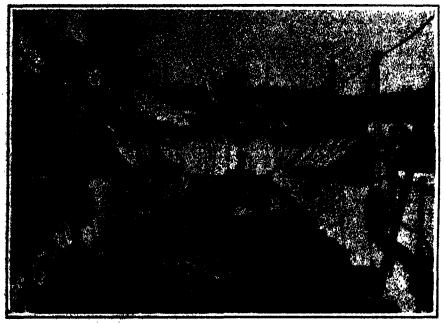
Next in fighting value to the four German-built ships above described are two protected cruisers, the "Hamidieh," built by Blewick in 1904, a ship of 21 knots speed and 3,800 tons displacement, mounting two 6-inch, 45-caliber guns and eight 4.7-inch, 50-caliber guns, and the "Medjidieh," built in 1904 at Cramp's yard in this country, a ship of 22¼ knots and 3,330 tons displacement, mounting the same battery as the "Hamidieh." The "Hamidieh" distinguished herself during the recent Balkan war. These two cruisers, although they mount a much heavier battery than the "Breslau," are unable, like her, to cruise with the speedy "Moltke", on the other hand, the Russian Black Sea fleet contains no cruisers that are comparable with them for effectiveness in a cruiser engagement.

From the ships already mentioned there is a big drop in value to the other units. Thus, the Turks have the "Mesoudiyeh," built in England as far back as 1874, and reconstructed at Genoa in 1902. This vessel is of 10,000 tons displacement and 14 or 15 knots speed. She mounts two 9.2-inch and twelve 6-inch, and has a belt of 12 inches of soft iron armor, easily penetrable. Another old ship is the "Mitun-I-Zaffer," constructed in 1869, and rebuilt in 1907. She is of 2,400 tons displacement and 12 knots speed, and mounts a battery of four 6-inch guns. Her protection is 6 inches of old iron armor. To these must be added some eight or nine gunboats of from 200 to 775 tons and from 12 to 22 knots speed.

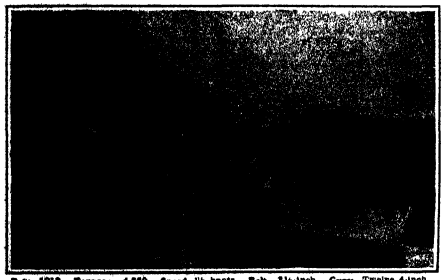
The Turks possess a fleet of eight modern destroyers of two classes, one of four boats of the "Samsoun" type, completed in 1910, of 305 tons displacement and 28 knots speed, mounting two torpedo tubes. The other class of four, named after the "Yadiklar-Milet" and built at Schichau, are fine boats of 620 tons displacement and 35 knots speed, mounting three torpedo tubes. The Turks also have nine torpedo boats of from 100 to 165 tons displacement and of 26 to 27 knots speed.

The Turkish fleet lost no time in getting into action; and already it has done considerable bombardment of Russian ports.

(Concluded on page 480.)

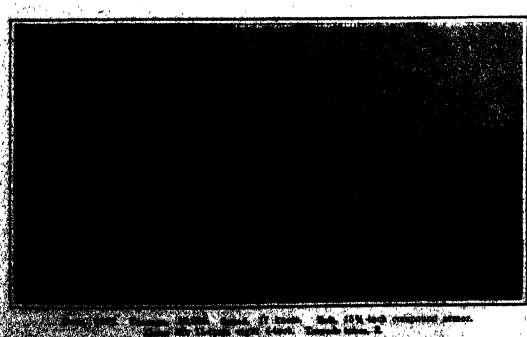


Inspection on board the battleship "Hairredin Barbarosse."



Date, 1912. Tonnage, 4,550. Speed, 25 knots. Belt, 3½-inch. Guns: Twelve 4-inch. Torpedo tubes, 2

Former German scout-cruiser "Breslau," now Turkish.



Date, 1906. Tonnage, 775 Speed, 22 knots Guns: Two 4 inch. Torpedo tubes, 3.

Torpedo gunboat "Peik-I-Shevket."

Is Germany Self-Sustaining in War?

Ability to Provide Food and War Materials from Domestic Sources a Great Element of Her Strength

By Benjamin Baker

How long can the German Empire feed its population from domestic products alone? Long before the outbreak of the present war, the question was much discussed not only by Germans, but by French and English writers as well. Dr. Carl Ballod of the University of Berlin took a distinctly pessimistic view of Germany's ability to feed herself in the Preussische Jahrbücher. *His article was a reply to Count von Moltke, who published far more optimistic views in the same periodical. In the article appearing on this page, Mr. Benjamin Baker, after carefully examining statistics, shows that Germany can support herself for fully a year.*—EDITOR.

GERMANY'S extraordinary isolation in both the military and commercial relations of the empire has been fully noted in the daily press; and much has been made of the fact that she usually imports about a third of the wheat she uses, and all of certain textile materials, such as raw cotton and silk. It has been confidently predicted that the war will result in the ruination of her foreign trade and the utter prostration of her industries; while it seems to be assumed, without much evidence of any careful study of the situation, that in the matter of food supplies particularly, the war will quickly lead to scanty fare, if not to widespread hardships, from actual lack of food.

But this notion, while it has something to support it, fails to grasp the fact that Germany can support herself on her home resources for fully a year, and that this capacity for self-support in the face of a universal embargo has a very high military value. It is probably true that long before next August, if the war were to last as long as that, the people of Germany would be put to many shifts from their usual mode of living. They might, for instance, have to learn to eat a greater part of their annual production of some two billion bushels of potatoes which are now mostly used in the production of industrial alcohol. In the absence of imports of raw cotton, they would undoubtedly have to economize on stockings, underwear, and shirts But they could very well do these things, and many others that necessity might require, without any real bodily suffering. The South, in our Civil War, cheerfully endured privations much greater than any of a material sort likely to afflict the German people in the course of a year's war

Germany is still largely an agricultural country, though the prominence of her manufactured goods in American markets has probably led most of us to think of her as mainly a commercial nation Nine tenths of her area of 208,000 square miles, inhabited by some seventy million persons, is productive. Her arable lands, including vineyards and other cultivated tracts, total over 65,000,000 acres, or practically half the entire area of the country At a pinch she can feed herself for a long time. She is similarly self-sustaining, but more so, in the matter of all military supplies and appliances. Besides the cultivated lands, grass meadows and permanent pastures take up over 21,000,000 acres, while woods and forests occupy 35,000,000 acres. In 1910 over 10,000,000 persons were engaged in agriculture on a total of five and three quarters millions of separate inclosures or farms. Many of these farms were very small, but the enumeration takes in none under three acres in area The largest estates are in East and West Prussia and in the Prussian provinces of Pomerania, Posen, and Saxony; while small farms are the rule in the Prussian Rhine province, in Baden, and in Wurttemburg. It is noteworthy that the agricultural population, living by farming, and living on the farms, is only about a million less than the total number of persons engaged in manufacturing pursuits, including the textile industries—or ten millions for farming against eleven millions for all manufacturing.

Cereals the Food Problem for Germany.

The statistics of home production and of imports of cereal foodstuffs probably present the German food situation in a somewhat worse light than the facts as to all the food supplies justify. Germany is an exporter of beef in large quantities to both England and France, yet in the current discussion of the food issue this fact, and its significance to Germany under the present circumstances, is wholly overlooked.

Germany's home production of foods from the soil last year, 1913, totaled 84,783,000 metric tons, the metric ton being the unit for all the official German statistics of production The metric ton equals 2,204 English pounds, or nearly the "long ton" with which Americans are familiar The figures in metric tons can be roughly converted into bushels by multiplying the figures in tons by 37.6 This would give the cereal production of last year, plus potatoes, at about 3,285,000,000 bushels, or 47 bushels per capita for the entire population of the country From a dietetic point of view, the proportion of potatoes is of course too high. In detail the crops for 1913 were

	Metric Tons	Bushels
Wheat	4,650,000	176,000,000
Rye	12,222,000	462,000,000
Barley	3,673,000	138,000,000
Oats	9,714,000	366,000,000
Potatoes	54,121,000	2,000,000,000

Imports of grains in 1913 are given in the German official figures by their values in marks, the values can be converted into dollars by dividing the figures in marks by 23.8, that being the value of the mark in our currency at the par of exchange. A rough method is to divide the figures in marks by four, to get the value in dollars. The imports last year were:

	Marks.
Wheat	429,000,000
Rye	44,000,000
Barley	407,000,000
Indian corn	106,000,000
Total	986,000,000

As given by the U. S. Department of Agriculture, the cereal imports of Germany were:

	Bushels.
Wheat	89,235,000
Barley	107,873,000
Corn	34,966,000
Oats	16,767,000
	Pounds
Rice	474,747,000

About 7,000,000 bushels of rye were exported in the same period.

The tables of production and of imports of cereals show that Germany now imports about one fourth of the wheat she uses, and naturally all the rice, the imports of rice being somewhat larger than those of wheat. In the period from 1900 to 1905, both years included, the four cereal crops named in the first table above averaged about 840,000,000 bushels, and during the same period the imports of cereals averaged about 170,000,000 bushels, or nearly one fifth of the home production. Barley is imported largely from Russia, little of this Russian grain being fit for the manufacture of beer. Possibly there may be relief in this direction in a much diminished brewing of beer, releasing the home supply, or much of it, for a different form of consumption.

Tabulating the production and import of cereals, however, does not wholly clear up the details of the food situation of Germany, because of the fact that, while the total imports of foodstuffs last year amounted to a little over seven billion marks, the cereal imports given in the second table above total less than one million marks, exclusive of rice; and with rice included, the total will hardly rise above the million mark, or one seventh of the total food and agricultural imports.

Fish, which has been generously imported, will be largely cut off by the war. The total value of the German fisheries in 1912 was about a billion dollars, and this was supplemented by imports mainly of cod and herring. Most of this came from the North Sea, and its failure will be felt in the large seaports on that coast.

Cattle Industry Makes Exports.

Cattle raising is a very important part of Germany's production, furnishing an excess which has supplied a growing volume of exports to both France and England. The retention of the beef formerly exported will of course add considerably to the home food resources of the empire. Cattle raising is mainly carried on in the south and southwest of Germany, the pastures in the foot-hills of the Alps supporting large numbers of animals.

Horse breeding is another animal industry that is carried on with great success both as to numbers and as to quality of animals. The main centers for this industry are in East and West Prussia, which is a great plain region; the marsh districts of the Elbe and Weser, to the northwest, and some parts of Westphalia, Oldenburg, Lippe, Saxony, and Upper Silesia. The stud farms of Trakhinen in East Prussia, and Graditz in the Prussian province of Saxony, have a European reputation.

Sheep have been declining pretty steadily in Germany since 1860, the number having fallen from 28,000,000 at the earlier date to some five or six millions now. This represents not only a decrease in home meat production, but also in wool supply, a large part of which now has to be imported for the textile industries.

Plenty of War Material and Plants.

As to war material of every sort, Germany is entirely self-contained. Her great shipyards and the enormous armor and gun plant of the Krupps are known the world over. She can not only build the machines of war, but she has the raw materials within her own borders. Up to recent years Germany imported Swedish iron for the making of steel by the Bessemer and open hearth processes; but since the Bessemer process has been modified to make use of phosphorus-bearing iron ores, Germany has made her steel from the abundant ores of Lorraine and Luxemburg, and has built up a large export trade in bridge and railway material, which she has sold largely to Russia and France. In engines and machines she ranks next to England, and her exports of these cover the world.

The mineral production of Germany in 1912, in metric tons, was:

	Tons.
Coal	174,875,000
Lignite (brown coal)	80,935,000
Iron ore	27,900,000
Zinc ore	644,000
Lead ore	142,000
Copper	974,000
Rock salt	1,296,000
Potash	11,161,000
Other products	583,000

Total value, $564,000,000.

Here are all the raw materials for guns, armor, and explosives with the exception of cellulose; possibly there would be a shortage in the lead supply if the war lasted indefinitely. The large imports of copper, which last year reached the value of 351,000,000 marks, might suggest that the cutting off of this outside supply would affect war equipment in some way. If we assume that the imported copper cost 13 cents a pound, the imports amounted to about 640,000,000 pounds, or somewhat less than one third of the domestic production. The unlikelihood of the suspension of copper imports affecting the supply of war material appears when we find that Germany's exports of copper wire last year amounted to a billion and a third of marks. This is four times the value of the copper imported, and strongly suggests that all the copper imported was brought in for manufacture and subsequent export. It is interesting to note that copper wire represented the highest value of any single article or class of articles exported.

Government and Private Revenues Cut.

The cessation of imports, if it continues long, will cut off a government income from customs duties which amounted in 1911 to $212,000,000, and would be more than that this year The greater part of the imperial income, or at least half of it, is derived from other sources, such as various excise taxes and the income of the imperial railways in Alsace and Lorraine. The cost of the recent expansion in the size of the army has been met by levying special taxes on the German states and on the property holdings and incomes of individuals. A prolonged cessation of commerce will cut off a considerable total of private and banking income through the interruption, or loss, of interest on foreign loans and investments, and this loss will lessen the taxpaying capacity of the people.

A larger loss in taxable resources will come from a prolonged cessation of the industries which depend on the export trade. Germany imports all her raw cotton and silk and a considerable part of her wool for manufacture. The early cessation of the textile industries is therefore inevitable, and this will add hundreds of thousands of idle people to the other great numbers thrown out of work by the failure of the export trade.

Calcium Bread

THE importance of calcium in the human dietary is discussed in a recent article by O. Loew, who urges the desirability of supplying this element, when needed, as an ingredient in bread. The author states that only those adults who use milk and vegetables in abundance secure a sufficient amount of calcium, while those who eat much meat and get their carbohydrates in the form of bread, potatoes, and beer do not. The amount of calcium in the diet appears to be related to certain pathological conditions, such as arteriosclerosis. It is proposed to use in bread-making baking chalk and a commercial preparation called "sanitas" made from rye flour and calcium chlorid. The author thinks it more practical to add calcium to the flour than to attempt to persuade the public to adopt vegetable bread.

Campaigning in Winter

Climatic Factors in the European Struggle

WHAT the coming winter will add greatly to the privations and hardships of the warring European armies cannot be doubted. It is true that improvements in military methods and equipment have made impossible such colossal horrors as those attending Napoleon's retreat from Moscow or even those incidental to the operations of the allied armies in the Crimean war; yet the rigors of winter are still a factor to be reckoned with in both the strategical and the humanitarian aspects of war.

As to the sufferings entailed upon the soldiers, a few illustrations will show that these are still inevitable. Of the fighting in Manchuria in January, 1905, during the Russo-Japanese war, Sir Ian Hamilton says: "Horsemen galloped about the field with the foam and dripping sweat of their horses changing into a crust like snow and long dangling icicles. The Fifth Division—only seventy yards distant from the Russians, near Heikoutai—had the choice between frost and fire. When they stamped their feet to keep life in them, the Russians, expecting an advance, fired on them. When the Japanese remained quiet they lost their toes. Four hundred of them were found to be suffering from *tosho* (frost-bite) the next morning."

An episode in the defence of Plevna in 1877, which might well be repeated to-day, is recorded by Capt. W. V. Herbert: "The sentry service in our own redoubt," he writes, "as well as throughout the camp, was of a cruelly severe character in the rigor of a Bulgarian winter. The original four hours had to be reduced to two, and then to one hour. Fixed, almost buried alive, in a hole 4 feet deep, with the upper part of the body exposed to the bitter blasts, the lower embedded in the frozen ground, unable to move (the slightest attempt at a trot, the very act of stepping out of the hole, attracted the enemy's bullets), insufficiently fed, compelled to exercise ceaseless vigilance, struggling against the dangerous drowsiness engendered by frost, the men looked upon sentry duty as the last refinement of torture."

Of the sufferings and mortality of wounded soldiers left lying for hours in the open in severe winter weather it need only be said that "progress" in the art of war has made no change in immemorial conditions—except an enormous increase in the number of sufferers.

From the strategical point of view wintry weather is not an unmixed evil. In western Europe the worst weather for military operations prevails in autumn, when the rainfall is at its maximum. Cold weather sets the roads, makes the sodden fields practicable for marching, and bridges over small bodies of water. Only in the mountain passes are these advantages offset by the obstruction due to snow. In the interior of the continent—e. g., on the East Prussian and Austrian frontiers—heavy snowfall occurs even over the plains and lowlands, and opposes an obstacle to military movements. Here, also, the intense cold freezes over the larger rivers; thus the Vistula is normally frozen at Warsaw from late December to early March. On the other hand, when not frozen over but filled with floating ice, these streams become impassable even by boat.

Again, it is difficult or impossible to dig trenches in frozen soil, such as may be found in the dead of winter in the interior of the continent. Under such conditions armies have, however, sometimes used blocks of ice to good advantage in building breastworks.

Strange to say, the circumstance of being accustomed to a cold climate does not appear to give any decided advantage to troops campaigning under winter conditions. T. M. Maguire, in his "Outlines of Military Geography," says: "When the theater of operations is entered, nothing is of much importance except military organization. The inhabitants, however well used to the climate, will perish if unprepared, while the invader, if provided with all requisites of clothing, food, and drink, will thrive." In the Balkan campaigns of 1877, the Russians suffered more from cold than from the Turks. Even the supposed superior stamina and military prowess of the inhabitants of cold, as compared with those of warm climates, is largely mythical, as may be seen by comparing the very unequal warlike qualities of the different races of northern India, who live under nearly identical climatic conditions.

The two main theaters of the present war differ greatly from each other in their winter climates. Western Europe enjoys comparatively mild winters, under the influence of prevailing westerly and southwesterly winds from the Atlantic Ocean, which, like all large bodies of water, has but a small range of temperature from summer to winter. The climate is, however, very moist, so that a moderate degree of cold produces much discomfort. Cloudy weather prevails considerably more often than in any part of the United States, except perhaps the region of the Great Lakes and the extreme North Pacific coast. As we go inland we find no abrupt change of conditions, as there is no large range of mountains running parallel to the Atlantic coast, to form a climatic divide; very gradually, however, the climate becomes more continental, and the present eastern theater of the war lies in a region that is intermediate in climate between the marine conditions of the western coast and the truly continental climate of central Russia.

The snowfall increases generally from west to east; not because of an increase in the total precipitation (rain plus snow), for this actually decreases, but because, with lower temperatures, a larger proportion of the precipitation takes the frozen form. The snowfall also increases markedly with altitude.

Both regions are subject to rapid and frequent changes in temperature under the influence of barometric depressions passing from west to east, although, especially in the eastern region, these are somewhat less frequent than in the northeastern United States, as the main European storm-tracks lie north of the war zone.

With respect to temperature and snowfall, one might say in very general terms that the western theater of war has the climate of South Carolina, while the eastern has that of Iowa.

A few comparisons of mean midwinter (January) temperatures may be instructive: Ostend, 39; Brussels, 37; Liége, 37; Luxembourg, 34; Aix-la-Chapelle, 30; Dantzig, 28; Posen, 29; Königsberg, 26; Warsaw, 26; Prague, 30; Lemberg, 24.

New York, 30; Boston, 27; Chicago, 24; St. Louis, 31; St. Paul, 12; Denver, 29, New Orleans, 53, San Francisco, 50

Dual-engined Aeroplanes

FIVE years or so ago the engines available for aeronautical purposes were scarcely distinguishable from motorcar engines. The evolution that has since taken place has been one of the most remarkable chapters in the history of aviation To-day, the aeroplane motor stands in quite a distinct class by itself, and we can make our choice not from one or two, but from a dozen or more types. The improvement of the design is now a matter of detail, and is being pushed on with vigor. Even within the last year the progress made has been great. For one thing, the aero engine is gradually being made more efficient as regards its consumption of fuel and oil. For another, it is being made more trustworthy and less liable to fail at a critical moment and precipitate a "forced descent." Nevertheless, "engine trouble" is still the most frequent cause of untoward events in the aviation world, and from this we must recognize that good on the whole as the aero engine of to-day undoubtedly is, it is still far from perfect From all points of view, and from the military especially, the possibility of the aviator's having to make an untimely landing is disquieting and a source of annoyance, and as a way of reducing this possibility in a great measure it has frequently been proposed to duplicate the power plant. Machines of this type are, in fact, already in existence or under construction, and we may expect that in the immediate future dual-engined aeroplanes will be less than exceptional.

In a way, the proposal seems like a counsel of despair It implies an apparent lack of faith in the possibility of producing a motor much more trustworthy than those in use on the aeroplanes of to-day. To carry an unreliable spare engine through the air in order that it may be at hand to replace another, equally unreliable, in the event of a breakdown on the journey certainly does at first sight appear like the last resort from a desperate position It is merely a temporary solution. For the time being the aeroplane has overtaken its engine If the progress that has been made in artificial flight is not to receive a check, there must be available a means of propulsion from which the chances of failure at a critical moment have been eliminated to a much greater degree than they are at present in even the best of our aero engines The whole trend of design demands it We are confronted with this need for a more trustworthy power plant on every hand, for the size of machines and the length of journeys are increasing rapidly, and the larger the craft and the longer their flights the more vital is it to avoid an unintentional landing and the bigger is the stress put upon the motor It is on the motor that the progress of the aeroplane in the next few years will chiefly depend. The engine builders recognize this quite clearly themselves, and admit the necessity of meeting the demand by approving, for the time being, of the duplication of the power plant When the improvement of the engine comes, as it certainly will, we may not, however, see the dual-engined aeroplane consigned to the museum of antiquities. The type will probably persist, for apart altogether from the question of guarding against breakdown, much can be said in favor of fitting two engines in place of one. Of primary importance is the matter of weight. Two engines may actually weigh less than one engine for the same power With the larger and larger horse-powers now being put into aeroplanes we have almost, if not already, reached the point where weight will be saved by using duplicate engines. Again, dual engines being most naturally arranged side by side and not in tandem, permit of keeping the *nacelle* free from much that encumbers it when a single engine is arranged on the center line of the machine. The pilot's comfort and safety are thereby enhanced With dual engines, too, we would naturally have dual propellers with their attendant advantages and without the disadvantages of chain or gear driving On this point we may express the opinion that as the size of aeroplanes increases, the necessity for reducing the over-all diameter of the propeller will, in any event, lead manufacturers to return to the dual propeller arrangement, and that to save the loss arising from some form of transmission drive each propeller will normally be direct coupled to a separate engine.

It appears, then, that what to-day is a temporary solution propounded for safety's sake will come to be adopted for the sake of efficiency and convenience as standard practice It must not, however, be overlooked that safety is at least of as much importance as efficiency and convenience In adopting the dual engine arrangement for the latter reason we should not neglect to take advantage of the increased safety that the system makes possible.

Thus, while for the sake of efficiency and convenience we may divide the power equally between two motors, we must for the sake of safety see that either motor is capable of driving and sustaining the machine when the other is idle, as by breakdown. Some difficulty may be experienced in carrying this out, for it obviously means that the machine should be able to fly and be controllable at half power, or that normally the two engines when running together should each be considerably throttled down. The latter seems the better solution, for it is always desirable to have a good margin of power in hand The mechanical difficulties introduced by the efficient and safe dual drive are not very serious, and have, we know for certain, been surmounted in at least one design. What is required is a simple means whereby either engine can drive either or both propellers. This has been accomplished in one design by a simple system of gearing. Finally, as the breakdown of one engine will have a smaller and smaller effect on the behavior of the machine as a whole, as the number of separate engines and propellers gets greater and greater, we may expect that ultimately aeroplanes will be driven not by two engines requiring some change mechanism between them and their propellers, but by several small engines, each direct coupled to a separate propeller.—From *The Engineer*.

Extension and depth of the snow-cover in eastern Germany during an average winter.

	Longitude East	October		November		December		January		February		March		April	
		Days	Depth (Ins.)	Days	Depth (Ins.)	Days	Depth (Ins.)	Days	Depth (Ins.)	Days	Depth (Ins.)	Days	Depth (Ins.)	Days	Depth (Ins.)
[illegible]	15° 50'	0.1	...	3.7	...	13.9	0.8	17.8	2.2	15.1	1.1	7.4	0.4	0.6	0.08
[illegible]	18° 0'	0.4	...	3.7	0.4	16.6	1.0	17.2	2.3	16.0	1.7	7.4	0.4	0.5	
[illegible]	20° 0'	1.3	0.04	4.6	0.3	19.4	1.6	21.9	3.3	19.3	4.0	10.9	1.0	0.8	0.04
[illegible]	21° 30'	0.3	...	1.8	0.1	13.5	1.5	19.4	3.1	19.8	4.3	11.4	1.7	0.1	...
[illegible]	23° 30'	1.4	0.04	6.0	0.3	25.5	2.0	27.2	4.6	25.8	7.1	20.6	3.7	1.9	0.08

Extension and depth of the snow-cover in eastern Germany during an average winter.

Each horizontal line gives the number of days the ground is covered with snow and its average depth at typical places.



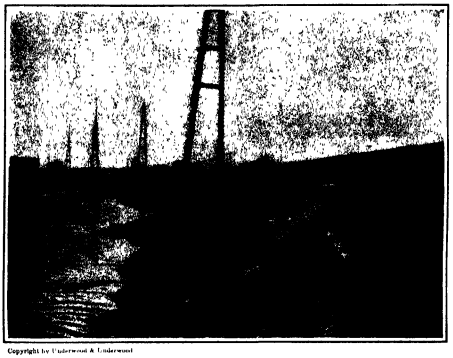
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German trench protected from shell fire by wire coils.



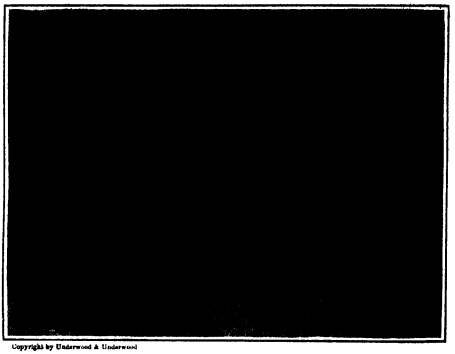
Photograph by Paul Thompson

Cable armor on a British locomotive in South Africa.



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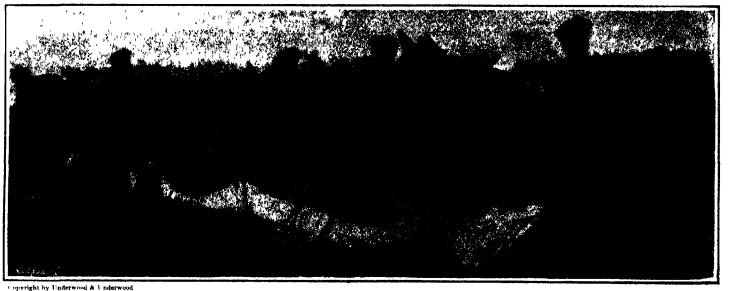
The flooded Ypres Canal. Note the shelters in the bank.



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French troops bivouacked in the streets of Paris.





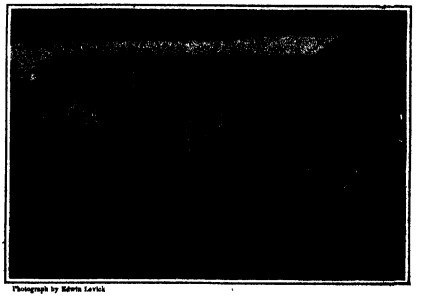
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Indian troops in the New Forest watering their mules.



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German field wireless telegraph station at work.



Photograph by Edwin Levick

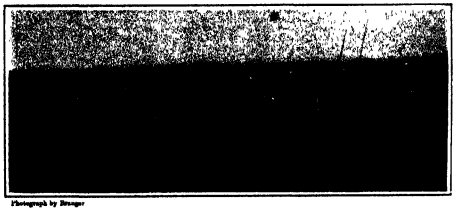
French dragoons shoeing their horses by the roadside.

EVERYDAY WAR SCENES AND OTHER PICTURES OF INTEREST



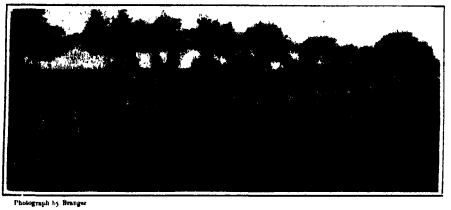
Photograph by Paul Thompson

The second battalion of the famous London Scottish rehearsing a charge.



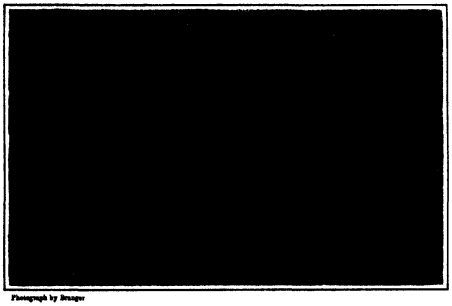
Photograph by Brauger

A patrol of French dragoons reconnoitering.



Photograph by Brauger

German infantry manning a trench.



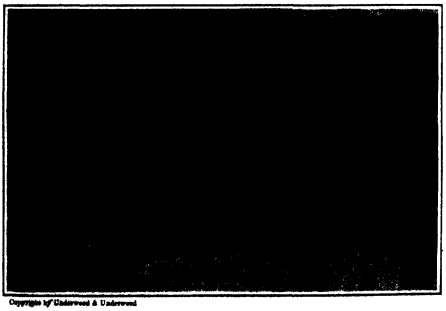
Photograph by Brauger

French infantry marching to the firing line.



Photograph by Brauger

Belgian riflemen defending the approach to a village.



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British marines fighting from the trenches.



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A company of Russian soldiers on the march.

A FEW OF THE VARIED TYPES OF SOLDIERS IN THE EUROPEAN WAR

Mining and Countermining of Fortifications

Capturing a Fortification by Trenches and Tunnels

THE Germans and Austrians with their 11-inch and 12-inch howitzers and their 16½-inch siege mortars, have found a new and very speedy way of reducing fortifications—always provided that the troops of the enemy permit them to bring this heavy artillery within range of its objective.

Not all of the nations engaged in the World War, however, are provided with such heavy pieces; and if any one of them attempted the reduction of a first-class fortification, they would have to resort to the time-honored method of attack by open approach trenches and by tunnels, driven below the very walls of the fortification itself.

In reducing a strongly fortified place the first step is to cut off communication with the outside world. A rapidly moving, comparatively small force, followed by reinforcements, is thrown entirely around the position, the force being beyond range of its artillery, or say, about three miles from its main lines of defense. This is known as the line of investment. It will be held in stronger force at some portions of the line than others; but everywhere it will be sufficient to cut off all exit from or ingress to the fortification. The zone of investment is entrenched, communication by telegraph and telephone is established between the different sections of the investing line, and communication is also established to headquarters.

When the line of investment is complete, the attack is pushed forward from one or more positions, the selection of which is determined by the following concomitant conditions: It must afford a good communication with the base; it must offer the best topographical conditions for emplacing the siege batteries, and for working up to the fortification under natural cover of the country; it must offer the most favorable ground for the construction of siege railways; and the selected line of approach must be favorable for digging operations.

When the direction and location of the attack have been decided, sites for the siege batteries are selected at distances of from three thousand to five thousand yards, according to power and range of the siege howitzers available. The attack on the fortress then commences, and the artillery fire is maintained until that of the defense has been silenced or at least partially smothered. The attack then attempts to gain ground toward the fortress; outposts are advanced and an effort is made to control the country in front for a sufficient distance to make it possible to dig the first trench parallel to the line of investment, if it be possible, within about 1,200 yards of the point to be attacked. The position chosen for this trench is reconnoitered, and at night an attack is pushed forward in order to drive the enemy in as far as possible from the position thus selected for this trench, which is known as the first parallel. In the dusk of the evening, a party, consisting of an engineer officer, a non-commissioned officer and a private for each fifty yards of the proposed length of parallel, move forward, and they carry with them tracing tapes of white cotton fifty yards in length. The officer carries also a compass to obtain the proper direction, and the line of the parallel is then "traced" or marked out with the tape.

Usually, if the fire of the defense is vigorous, the outposts commence work on the first parallel, by digging short lengths of it, which are afterward connected to a connection with each other. In the Japanese operations at Port Arthur, the parallels were about 6 feet in depth and 14 feet in width, or of sufficient width to permit troops to march through them abreast.

When the first parallel has been completed and occupied, two or three lines of zigzag trenches or approaches are dug in the direction of the fortress, until a distance of about six hundred yards from the objective has been reached, and here a second parallel is constructed and occupied. From the second parallel further advance is made by approaches, until a position has been reached within about half the distance between the second parallel and the fortress. Here the third parallel is constructed at a distance from the objective of say about two hundred and fifty to three hundred yards.

The excavation of approach trenches, under fire, is different from the ordinary parallel trench work, in that it proceeds progressively from its outer ends, and the men are fairly well protected from the fire while digging. The technical name of these approaches is "saps." The work is done by specially trained men known as "sappers." The head of the trench toward the enemy is known as the "sap head," which is pushed forward by an officer and eight "sappers," who work in two reliefs. The sappers are protected at the end of the trench by a gabion filled with earth, and by a parapet sufficiently high to form a two-foot loop parapet. Another one "sapper," kneeling, protects the rear of the trench and brings down the earth. Then number two takes his place and shovels the loose earth away, which is thrown out on the side of the approach away from



This shows how the investing troops, by the use of diagonal and parallel trenches, are able to concentrate within storming distance of the besieged fort. From the inner parallel a tunnel is driven below the outer wall and a charge of high explosive serves to breach the fort and permit the storming party to make its final rush.

Capturing a fortress with pick and shovel.



This view shows the besiegers driving a mine gallery below ground from the inner parallel of their trench system to a point below the fortification. Below it are the countermine galleries of the defense.

Mining and countermining in the attack and defense of a fortress.

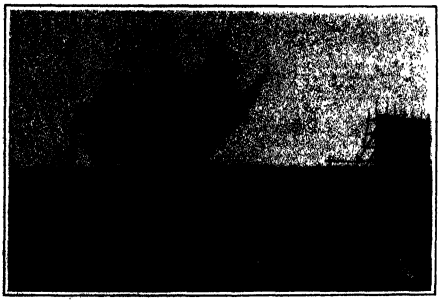
enemy to afford protection; or, if the approach is to be covered, the material is carried to the rear on stretchers (as in the case of the Japanese approach to Port Arthur) or by other means, and is deposited out of sight of the enemy. As the "sap head" is advanced, the sandbags are pushed forward by rolling them over by hand, or by the use of a fork, and the undercutting and shoveling are proceeded with until a diagonal trench a hundred feet or so in length has been dug, say in a lefthand direction. Then the approach is driven in a similar way to the right, and so on, until the required distance has been gained.

When the third parallel, within charging distance of the fortification, has been dug and occupied, it may be found that the base of the fortress is too high or difficult for a direct attack with scaling ladders or the other storming equipment. In such a case, it will be decided to make a breach in the wall of the fortress by blowing it up. This operation is achieved by what is known among military men as mining, which consists in driving a horizontal tunnel until it reaches a point below the fortress; placing at the farther end of it a charge of explosive; and blowing a breach through which the attacking troops can enter. These tunnels are known as "galleries," and as the work must be expeditious, they are made as small as possible, the common size being three feet in width by four and one half feet in height. To prevent caving in, they are usually timbered or lined, the lining being prepared beforehand, and cut to exact sizes, so that it can be put in place rapidly as the work of excavating progresses. When the gallery has been carried to the desired point below the fortress, a heavy charge of high explosive is placed at the end of it in a prepared chamber, and everything is ready for the final shock attack.

The storming of the fortress will generally be done at night, and it will be preceded by a violent and unceasing bombardment from the siege artillery to the rear, the object of which will be to work all possible damage with high explosive shells, keep down the fire of the defense, and generally shake up its *morale*. Meanwhile the picked troops selected for the first rush will have passed, by way of approaches, to the third parallel, confronting the fortress, and back of them in the outer parallel and approaches will be the reserves.

When everything is prepared, the mine is detonated, and through the breach made in the walls or parapets, the storming party makes its rush from the third parallel, being strongly supported by the troops in the approaches and parallels to the rear.

In view of the great peril to the defense of the approach by mining, a system of defense known as countermining has been evolved. In countermining a shaft is sunk by the defense within the fortification, and from this a *main* gallery leads out to a transverse gallery from which a system of small radiating galleries is constructed, covering the terrain which to military eyes appears to present the most favorable direction for attack. In many permanent fortifications the countermines are dug at the time of the construction of the fortress and form part of its permanent defenses. At other times they are commenced only when the direction of the attack has been approximately located by the defense. Men are sent out into the counter-mine galleries, and they listen for the slightest sound of the working tools of the attack. When the location of the enemy has been determined, explosives are placed in the countermines and the working galleries of the enemy are blown up. It is interesting to note that in the present field operations mining and countermining are reported to have been resorted to by both the Allies and the Germans in the open field entrenchments in France and Belgium.



Detonation of a 12-inch shell filled with high explosive and buried six feet below ground.

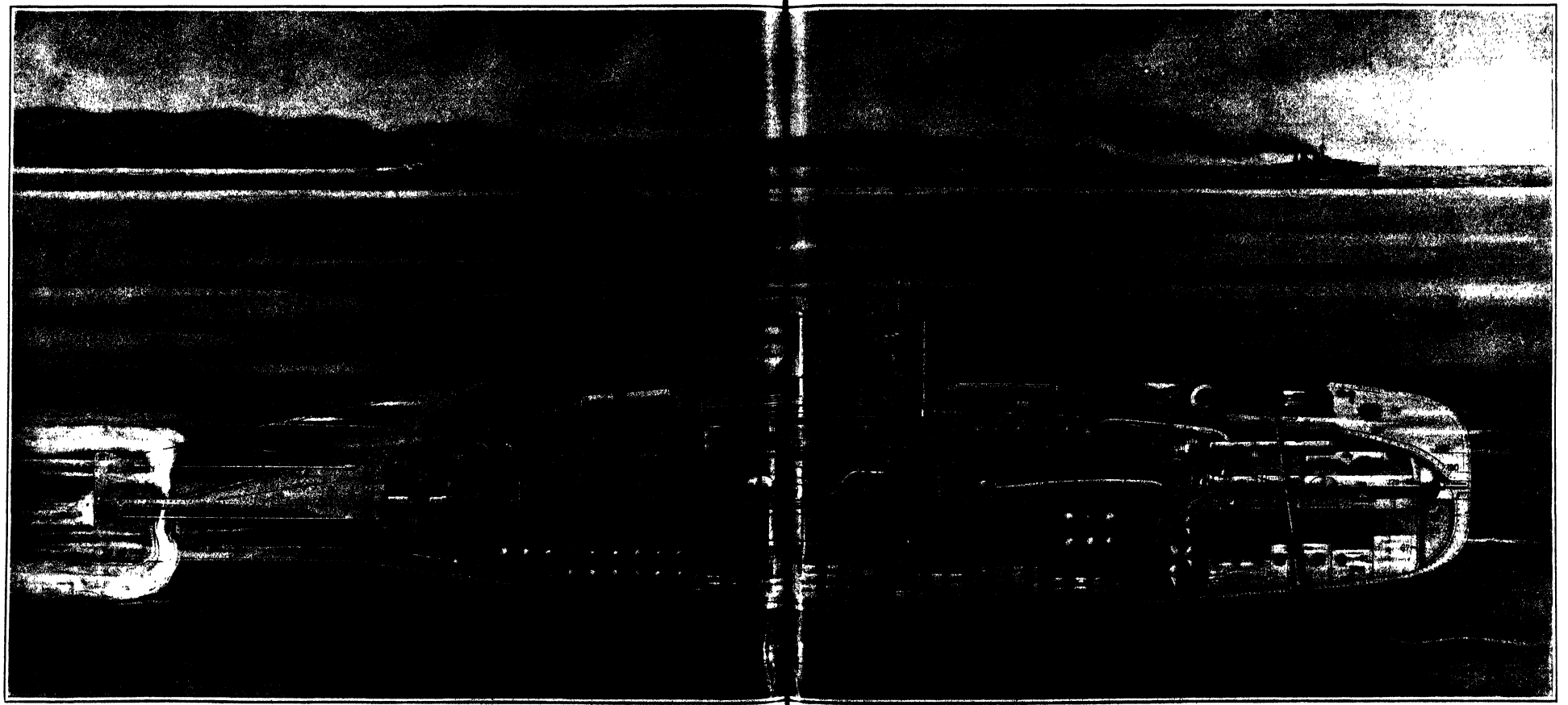


Photograph by Paul Thompson

Digging trenches of the type that is secure against front and cross fire.

REFERENCE LIST OF PARTS SUBMARINE SHOWN BELOW

1 Periscope
2 Surface signal halyard
3 Surface running light
4 Surface signal light
5 Surface side light box.
6 Surface helm compass
7 Surface navigator's compass
8 Surface steering wheel.
9 Periscope support
10 Life rail
11 Central access hatch
12 Dog for access hatch
13 Water-tight vent covers.
14 Water-tight periscope stuffing box.
15 Fore stay
16 Forward life line
17 Under-water compass
18 Periscope eye piece
19 Observation ports.
20 Depth meter
21 Conning tower
22 Engine room speaking tube
23 Torpedo and diving station speaking tube
24 Under water steering wheel
25 Periscope turning shaft
26 Forward vent pipe
27 Emergency tank blowout lever
28 Battery acid neutralising lever.
29 Depth gage
30 Pressure gage
31 Electric light.
32 Air pressure gage (after system).
33 Automatic sea opening tell tale and diving rudder lock.
34 Diving wheel.
35 Diving wheel gear box
36 Vent pipe gate valve
37 Periscope motor
38 Battery acid neutralising tank.
39 Air pressure gage (forward system)
40 Ventilating blower
41 Torpedo intake runway
42 Water tight torpedo hatch
43 Windlass motor
44 Windlass
45 Torpedo tube air valve
46 Torpedo tube air tank
47 Torpedo compensating tank.
48 Torpedo cap turning mechanism
49 Torpedo cap
50 Torpedo
51 Torpedo launching tube
52 Cable nipper
53 Towing or mooring cable
54 Anchor cable.
55 Anchor cable fair leader.
56 Hawse pipe.
57 Stem casting.
58 Collision girder.
59 Forward trimming tank.
60 Fuel tank
61 Anchor housing tube.
62 Fuel tank.
63 Fuel tank swash plate.
64 Cement filling.
65 Collision bulkhead.
66 Mushroom anchor.
67 Water tight collision casting
68 Forward trimming tank suction pipe.
69 Submarine mine compartment
70 Submarine mines.
71 Torpedo launching lever.
72 Submarine mine trolley
73 Water tight manhole cover.
74 Water tight door to mine compartment.
75 Ladder grab rods.
76 Submarine mine discharge hatch
77 Forward air flask compartment.
78 Compressed-air flask.
79 Battery testing set.
80 Portable wood shutters over batteries.
81 Forward battery set.
82 No. 1. Balancing tank (forward set)
83 No. 2. Balancing tank (forward set)
84 No. 3. Balancing tank (forward set)
85 Tank control manifold valve.
86 Fuel oil suction.
87 After balancing tank suction and supply
88 Forward balancing tank suction and supply.
89 After balancing tank suction hand operating stem.
90 Fuel oil tank suction hand-operating stem.
91 Forward balancing tank suction, hand operating stem.
92 Main force and lift pump suction for after balancing tanks.
93 Main force and lift pump suction for fuel oil tanks.
94 Main force and lift pump suction for forward balancing tanks.
95 Main pump manifold.
96 Main pump cut out valve.
97 Conning tower access ladder.
98 Emergency ration locker.
99 Main pump suction and discharge pipe
100 After battery set.
[illegible]-driven air, fuel, and water pump.
[illegible] air compressing tank.
[illegible]sure gage.
[illegible] locker.
[illegible]n to steering engine.
[illegible]mpass light.
[illegible] vent pipe.
No. 3 Balancing tank (after set).
No. 2. Balancing tank (after set).
No. 1. Balancing tank (after set).
[illegible] motor.
[illegible]on pipe from vacuum tank.
[illegible] valve.
[illegible]uum gage.
[illegible]uum tank.
[illegible]ing valve gage.
[illegible] gage
[illegible] pump adjusting lever.
[illegible] pump.
[illegible] hatch plate to spare compartment
[illegible]
[illegible] hatch plate to muffler compartment
[illegible]
[illegible] intake shutters.
[illegible]ning tower cutwater.
135 Steering engine.
136 Main engine oil flood case.
137 Steering engine controller.
138 Main engine.
139 After air flask compartment.
140 High pressure air flasks
141 Air pipe to expander.
142 Flywheel clutch.
143 Engine air suction.
144 Strainer to after bilge suction system.
145 Bilge suction cut-out valve.
146 Conning tower control to main engine
147 Conning tower control to main motor.
148 Automatic lubricator
149 Conning tower engine-room indicator.
150 Main motor.
151 Clutch actuating lever.
152 Revolution indicator.
153 Revolution indicator shafting.
154 Main valve to sea opening
155 Air pressure oil cups.
156 Main shaft coupling.
157 Main shaft thrust bearing.
158 Pinion for oil agitator
159 Pinion for air cooler drive.
160 Thrust bearing foundation.
161 Intake pipe from sea opening
162 Circulating water outlets
163 Superstructure run
164 Superstructure connecting angle
165 Steering rudder operating rod
166 Diving rudder strut
167 Diving rudder operating rod
168 Keel and fin connecting angle
169 Fin keel
170 Propeller.
171 Steering rudder lever
172 Steering rudder
173 Stern casting.
174 Diving rudder
175 Diving rudder lever
176 Fin keel rudder support
177 Torpedo tube breech block
178 Torpedo tube air cut out valve
179 Stuffing box for torpedo cap stem.
180 Outer torpedo discharge tube
181 Fresh air ventilation terminals
182 Divers' exit compartment
183 Drain for diver's compartment
184 Flood for diver's compartment
185 Air blow out pipe for forward trimming tank
186 Water inlet for torpedo compensating tank
187 Air blow-out for torpedo compensating tank
188 Stuffing box for anchor tube
189 Swash plate lightening holes
190 Normal water line (above water condition)
191 Fire hose
192 Fire plug
193 Extinguisher
194 Diving rudder angle indicator
195 Air cooling coils
196 Electric heaters
197 Lamp locker
198 Engine telegraph
199 Whistle pull
200 Whistle

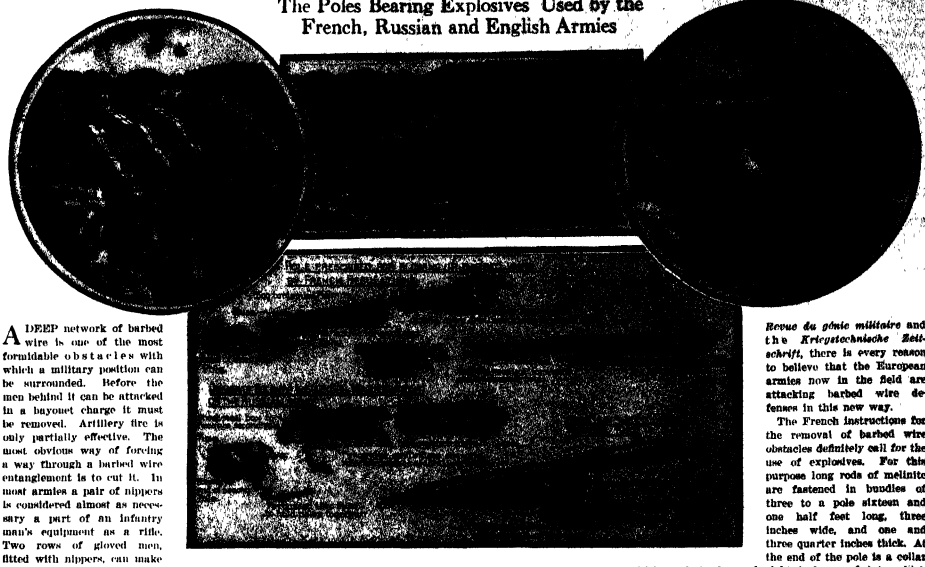


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SECTIONAL VIEW OF A MODERN SUBMARINE, SHOWING DETAILS OF CONSTRUCTION AND METHODS OF OPERATING IT AND ITS TORPEDOES

Blowing Up Barbed Wire Entanglements

The Poles Bearing Explosives Used by the French, Russian and English Armies



A DEEP network of barbed wire is one of the most formidable obstacles with which a military position can be surrounded. Before the men behind it can be attacked in a bayonet charge it must be removed. Artillery fire is only partially effective. The most obvious way of forcing a way through a barbed wire entanglement is to cut it. In most armies a pair of nippers is considered almost as necessary a part of an infantry man's equipment as a rifle. Two rows of gloved men, fitted with nippers, can make a passage seven feet wide in ninety-five seconds—this during maneuvers. What the time would be in actual battle under fire it is hard to state. Would it be less when machine guns are pouring in several hundred shots a minute? Or will the tense excitement of the moment and the sense of danger slow up the wire cutters? One can only guess. Psychologically it is more reasonable to expect slow rather than fast work during an engagement. There is bound to be much fumbling.

Rakes, Ladders, Planks, and Bags Have Been Used.

But the nippers have seemed too slow even during maneuvers. Experiments have been made in removing whole sections of wire at once by means of a rake, to which a wire rope is fastened. This is thrown over an obstacle, and thirty men pull upon the rope. Thus a section eleven and one half feet wide and sixteen and one half feet deep is torn out. In order to reduce the time required to pass through a barbed trap (the glint of the wire is usually concealed by a bank of earth) some military engineers have thought that it is a waste of precious minutes to cut or tear it down, and that it is more rational to surmount the obstacle in some way. Structures of boards, ladders, and bags should be thrown over the wire, according to their ideas, and upon the platform thus made the men can press forward. Boards eight feet long, nine inches wide and three quarters of an inch thick, are fastened together by means of three cross pieces, leaving a clear space of three inches between the boards. The weight of the double board is thirty two pounds, and sixteen of them are employed, each carried by a single man. To place the sixteen double boards on the wire net requires about one hundred and forty seconds, as actual tests have shown, and it takes seventeen men sixty seconds to pass over the boards. As a time saving expedient, therefore, the method is hardly a success over that of wire-cutting.

Nor are ladders much better. In some experiments, conducted in England, ten ladders with nine rungs each were used. Each ladder, twelve feet long and twenty-two inches wide, weighed thirty-two pounds, and was carried by a single man. The ladders were laid down in one hundred and forty-five seconds, and sixty-five seconds were required by seventeen men to pick their way from rung to rung.

That this idea of surmounting an obstacle rather than cutting a way through it is not practicable, is better shown by the experiments which have been made with bags of cloth and wire. Twelve bags each eight feet long and four and one half feet wide (measured empty) and weighing forty pounds when filled with straw, were placed upon a net in ninety-five seconds, and seventeen men passed over them in forty-five seconds. When the bags are made of wire poorer results are obtained. Such bags are composed of two pieces of wire meshing, eight feet long and four and one half feet wide, laid on top of each other and placed together at the sides with wire. A quantity of straw three inches thick is pushed into the wire bag, which then weighs only twenty pounds. It takes ninety seconds to lay sixteen of these bags on a barbed wire entanglement, and it takes seventeen men sixty-five seconds to pass over them.

The French Pole System of Blowing Up Barbed Wire.

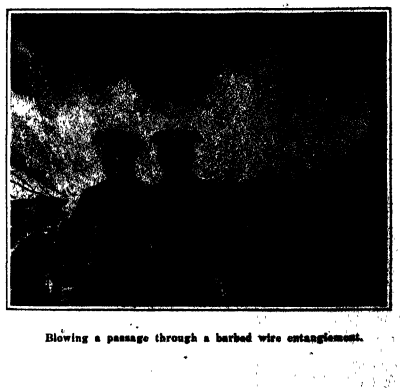
So important is this problem of coping with barbed wire that military engineers in Europe have given to it an immense amount of time and thought. Just before the war it was decided that the quickest way of disposing of barbed wire was to blow it up, and to achieve that end a system was devised by the French, which has been adopted in modified form by some of the great European powers. From articles that have appeared recently in the more authoritative military publications in the world, such as the *Revista di Artiglieri e Genio*, the *Royal Engineers' Journal*, the *Revue du génie militaire* and the *Kriegstechnische Zeitschrift*, there is every reason to believe that the European armies now in the field are attacking barbed wire defenses in this new way.

The French instructions for the removal of barbed wire obstacles definitely call for the use of explosives. For this purpose long rods of melinite are fastened in bundles of three to a pole sixteen and one half feet long, three inches wide, and one and three quarter inches thick. At the end of the pole is a collar which projects forward eight inches, and into which the end of a second pole is fitted, if the extent of the explosion is to be more than the length of a single pole. Each pole has a wooden head of almost conical form, with a steel cap and two little wooden wheels five inches in diameter. The pole is pushed straight into the mass of barbed wire or along the ground beneath it. Thanks to its form and to the little wheels with which the head is provided, it glides in easily enough. If necessary, another pole is fitted into the collar of that already in the network of wire. The charge is ignited by means of a fuse connected with the last bundle of melinite in the pole. Each pole supports ninety-nine bundles or packages of explosive, equivalent to about six pounds of melinite per meter (3.28 feet), and is carried by two men. A single pole will blow open a passage about thirteen feet wide.

The Russian Pole is a Modification of the French.

Very much the same system is used by the Russian army. The explosive is carried on poles seven to ten feet long, which are thrown upon the obstacle. The measure of success obtained depends very largely on the manner in which the poles are cast, particularly if the netting of barbed wire is very broad. The last pole may be thrust into the netting, which procedure is not always successful because the tip of the pole may strike the ground. The width of the passage effected by the Russian method is not more than ten feet. In actual practice it has been found that parts of the obstacle are not destroyed.

Because of the defects of their own system the Russians are employing poles resembling those prescribed by the French army regulations. Pyroxyline cartridges are secured to wooden poles from one inch to one and one half inches thick, three inches wide and six feet long. The poles are shorter than the French, so that they may be more easily handled. In one of our illustrations the method of joining two poles is shown. At one end of each pole is a tapered bolt projecting outward about one and three quarter inches. The other end of the pole is recessed to receive the tapered bolt of the following pole. The pole, which is thrust forward first has a head, as shown in the illustration, which head facilitates movement and prevents damage to the explosive. At the sides of the head are two little wheels of not more than three inches diameter, which enable the pole to be pushed forward readily beneath the lowermost wires. The charge is placed in a cloth sheath and fastened to the pole. About three and one half kilogrammes of explosive (eight and



Blowing a passage through a barbed wire entanglement.

(three hundred pounds) are distributed to the meter (3.28 feet). Capped cartridges are placed along the charge. The number of poles required for the opening of a breach depends on the width of the obstacle. If it is twenty-one feet wide three poles with eighteen feet of explosive will be sufficient. If it is twenty-eight feet wide, four poles with twenty-four and one half feet of explosive will be required. The total length of the explosive is from two to three feet shorter than the length of the barbed wire obstacle. One man can carry one pole. The poles are joined at the obstacle and pushed beneath it. This type of pole is very efficient.

Col. Kaskewitsch's Improvement.

The Russian pole is certainly more easily handled and carried than the French. But it has its objectionable features. The method of joining one pole to another by means of tapered bolts thickens the joint, so that it might be difficult to push joined poles forward. Capped cartridges must be used on the Russian pole, because the Russian explosive when strung out cannot be exploded with a single cartridge at the outer end of the pole. In the French system the explosive bodies touch each other at three points; in the Russian system at only one point.

It must not be supposed that the use of these French and Russian poles is not attended with mechanical difficulties, quite apart from the efforts which the defenders behind the barbed wire defense will make to frustrate the blowing away of their chief reliance. While the little wheels on the French and Russian poles facilitate the placing of the explosive within the netting itself, the poles cannot be easily pushed over ground in which holes have been dug or on which large stones have been placed for the very purpose of thwarting an attempt to blow a passageway in the wire. It may also happen that the barbs on the wire may cut the cord with which the explosive is fastened to the pole and thus scatter part of the explosive. The cloth sheath which the French use will not avoid this; for the cloth, too, may be torn by barbs and loose ends of wire.

To overcome these difficulties, Lieut.-Col. Kaskewitsch of the Russian army has designed still another type of pole. He abandons the two little wheels and in their stead fastens a rope to the end of the foremost pole. If a stone or a hole is encountered in pushing the pole forward, it can be lifted over the obstacle by means of this rope. The illustration explains the principle clearly. Another rope at the rear end of the last pole controls the lateral movement of the pole. Each pole consists of two wooden strips, *A* and *B*, held together by two perforated pieces of wood. The pyroxylin cartridges are held between these two strips *A* and *B* in such a manner that a long hole or conduit is formed through the entire charge. This hole serves the purpose of enabling the fuse to ignite in the whole charge. The cartridges are held in place by rubber disks, as shown. Each of these poles is four inches wide, five and one half inches deep, and about ten feet long. Two poles are joined in the manner shown in the illustrations, by means of a sheet steel box, to which a ring is fastened. By means of a pin the ring of one pole box can be secured to the double ring of another pole box

This design has the merit of holding the charge in a very compact form, also the merit of flexibility when stones are to be avoided. But the projecting rings are likely to catch in wires and offset these advantages. All things considered, the French pole is much simpler.

The English Torpedo Pole.

Before the outbreak of war, the English army conducted some experiments at Bangalore, India, the object of attack being a wire netting sixteen and one half feet wide stretched on posts one half to three quarters of an inch thick and six feet to six and one half feet tall. The English engineers decided that the charge would have to be at least as long as the breach to be made and that the explosion should occur at about half the height of the netting, so that it would exert its force in all directions. In their opinion the charge should be contained in a perfectly smooth sheathing which could easily pass through the wire.

To meet these requirements, an instrument called a torpedo was designed, which consists of a sheet steel tube two and one half inches in diameter and six and one half feet long, filled with explosive. As the accompanying picture shows, one end is closed; the other end is open, but is provided with a sleeve which projects about eight inches and which is intended to receive the closed end of another tube if charges longer than six and one half feet are to be fired. The number of tubes which are thus joined depends on the width of the obstacle to be removed.

Each of these tubes is filled with twenty-three packages, of which each contains four explosive cartridges Hence, a single charge of about five and one half pounds is good for a yard and one quarter. When several tubes are joined, the closed end of one touches the explosive of the preceding tube. Ignition takes place at the rear end of the last tube, and the explosion takes place through the entire mass without interference by the wall which separates the tubes. In order to facilitate transportation and ignition, each tube is provided with a point and a handle. The handle serves to close the open end of the tube during transportation, to prevent the explosive from dropping out and to receive the igniting device. It consists of a piece of pine wood one and one quarter inches long and is thick enough to fit snugly in the sleeve. At one end it has a hollow cylinder for a dynamite cartridge and cap. The fuse, which terminates at the cap, is threaded through a hole in the handle. A pin serves to connect sleeve and handle so so that the handle may not drop out The point, also of wood, is of conical form, and is held in place by a small iron sleeve of such diameter that it can receive the closed end of a tube This point serves to open a path for the pole, no matter how dense or complex the wire netting may be. An empty tube with its point and handle weighs about eight and one half pounds. Loaded with dynamite, a tube weighs twenty pounds, so that it can easily be carried by a single man If a torpedo longer than the six and one half feet is to be used, the first man pushes his tube into the barbed wire, point forward, and removes the handle. Then the second man removes the point of his tube and fits the end into the sleeve of the first tube and pushes the joined tubes forward So tube is joined to tube Only the first tube carries a point and only the last a handle. The results obtained with this system are said to have been exceedingly successful Whether French, Russian, or English poles are used, the attacking force entrusted with the hazardous task of forcing a way through barbed wire must retire for a distance during the explosion But how far? The French regulations state that the pioneers must retire one hundred and sixty feet in order that they may not be injured by their wire-destroying charges The Bangalore experiments proved that the men may stand within three hundred feet of the explosion without danger.



Rushing through a breach made in a barbed wire entanglement by a blast.



Poles, to which packages or cartridges containing powerful explosive are attached, are pushed through the barbed wire entanglement. A time fuse is lit, and the men retire for the blast.

Atomic Weights of Lead

A PAPER was presented at the French Academy of Sciences relating to researches made by M Maurice Curie, nephew of the late scientist, upon the different atomic weights of lead The radio-active theories according to which certain bodies, such as radium, uranium or thorium, can evolve in course of time and become transformed to other elements (a striking verification being given by the transmutation of radium to helium), lead to placing the metal lead as the last term of the series of changes This very common metal is thus derived from the rarest and most costly metal known. Another very curious idea is that if, instead of taking the radium-uranium family, we consider the thorium group, it is found that the last term of the evolution series is a body whose atomic weight is still very *near* that of lead. It was therefore of fundamental interest to verify these conclusions and see whether the metal lead which is found in uranium ores on the one hand, and the metal which is seen in thorium ores on the other, have or have not the same atomic weight as the lead extracted from galena M Curie made such researches, and found that ordinary lead from galena has atomic weight 207 01, while lead from uranium ores shows a clearly inferior value of 206 5 Metal from thorium ore gives a higher value of 207.1. The conclusions of theory are thus confirmed, and it is admitted that there are several varieties of lead having different atomic weights, according to the initial metal from which they were derived A new field of research is thus opened, and perhaps other *metals* will be found to present distinct atomic weights according to their origin, showing that the phenomenon of transmutation is much more general than is supposed.

Cars in the German Armies.—It is estimated that there are at least 20,000 motor cars of the commercial variety now in use in the German armies, including tractors for heavy guns; and there are *also* 10,000 trailer cars. Besides these there are about 25,000 pleasure cars used by officers as scout cars and for transportation to various points at the front. A large additional number of pleasure cars have been taken by the government for temporary use in the interior of the country, with the intention of returning them to their owners on the termination of the war.

The War Game and How It is Played

Mimic Warfare for the Schooling of Army Officers

WITHIN the walls of the War College, in the city of Washington, are great libraries of military history and text books of war; steel cases, jealously guarded, containing the published maps of all the lands of the earth, pamphlet after pamphlet of information regarding the terrain and resources of the different countries, garnered no one knows exactly how, and a high ceilinged room which contains, among other simple furnishings, a huge, soft pine table.

The yellow surface of the table top is seldom seen, for there is usually a map upon it; a map whose limits reach to the very edges, pricked here and there by little pins with vari-colored heads; and also, there is usually a group of quiet, intent gentlemen, officers of the Army, leaning over the map, moving the pins here and there or shifting wooden or leaden blocks from place to place.

It is in this room that the war game reaches its climax, at least in the United States; for the officers studying the map so intently are members of the General Staff, and they *are not playing*.

The very title of the game is misleading. It is most decidedly not a game; on the other hand, it is one of the hardest, most painstaking studies imaginable, for it necessitates an already gained knowledge of a host of matters which can only be acquired by years of experience, a profound recollection of the history of battles and campaigns which furnish evidence of what certain conditions in war almost invariably produce, a knowledge of map reading and topography which would equip any civil engineer or surveyor, experience with troops and marches, the effects of gun and rifle fire, logistics, mathematics, clear brains and foresight, resource, decision, and a number of other attributes too numerous to mention. And it is not played as a game, to see who will win, but to get results and experience, to profit by the very mistakes made.

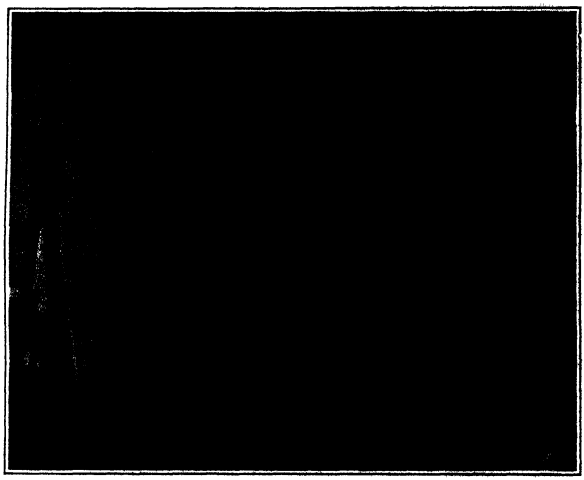
"Kriegspiel" comes to us from Germany. In the time of Frederick the Great the game took on its first semblance of application to the study of the art of war, an outgrowth of the game of chess, the earliest war game. It was first taken up as a diversion and, although in a crude form, it achieved considerable attention. It is used now in the instruction of every army of the world.

The *raison d'etre* of the game is easily apparent. Modern wars are short and infrequent, and when they occur there is no time to gain experience before the armed clash comes. As much of this experience as possible must be had beforehand in a way which is the best substitute for actualities. A great deal of this experience may be gained by maneuvers, but maneuvers are too expensive to be indulged in on a large scale very often; besides, they must necessarily be held, for the benefit of varied ground, in different places each time, and of course, on private ground, leased for the exercises; but in time of peace a body of troops may not cut up a farmer's land with trenches and march roughshod across his fields of waving grain, burn his buildings, mine the highway and blow up the community's bridges. But you may do all this and more upon a large scale map, where everything, even an isolated sentry post, may be indicated by a pin or a block.

The great organization of the armies which are now clashing abroad is due to preparation, worked out by the war game. As an example of this preparedness, it is told of Von Moltke, who was reading a book when news of the declaration of war between France and Prussia in 1870 was brought him, that he only interrupted his reading long enough to say "Volume 3, on the second shelf; it is all ready"—and with only that opening of the throttle, the machinery of war began to grind, true to its thorough preparation. Kriegspiel, then, is war in miniature, the representation upon a map of the progress of a campaign or a battle. The scale of the map is usually six or twelve inches to the mile, for tactical exercises, and on a map of this size, every rise and swale, every house and bypath, every well, stream, and clump of trees may be plainly marked and read.

Every inch of the German Empire is plotted in this way, and the sections, about a foot and a half square, may be bought by anyone desiring to have them. In the United States, the vast labor of making the military map is going on daily, though the layman will scarcely know it, and in the course of time the location of every farmhouse in the country will be known. Possibly this military map is already completed—who knows?—and tucked away until needed.

The game is played by two men, or two bodies of men. The map to be used is placed upon the table and an hour or so before the exercise is to begin each commanding officer, designated, respectively, as the Red and the Blue commanders, is furnished with a typewritten paper containing a verbal outline of the situation and the conditions, as to the enemy and the object to be gained; also with small maps of the field, such as would be used in actual campaign. Having had a brief time to consider the situation, he calls his subordinate officers about him and issues his orders, written on the regular order blanks, as used in service. These subordinate officers are supposed to be in command of the units and execute the orders of their commander by indicating on the table map, with pins or blocks, the positions they are to occupy, according to the problem, at the outset.



Large-scale war maps and hypothetical orders in the Kriegspiel room of the Army War College, Washington, D. C.

When the Blue commander has made his dispositions he leaves the room, and his territory or dispositions are concealed and the Red commander enters, with his officers, and completes his preliminaries. Then he commences his advance. There are scales which show how far infantry, cavalry, and artillery will advance in a minute, scales which show how much road space a company, a regiment, a brigade and a division, with the attendant wagon trains, etc., will occupy. The time required for every movement must be figured out promptly and exactly. The commander scarcely ever sees the table map, but from his small one makes his deductions and issues his orders. Probably in a few minutes movements have been executed to represent what has occurred in an hour's time. His pencils have pushed out into the enemy's territory, actually placed on the large map by the umpires who supervise the game; his troops have advanced a certain distance, his infantry here, his artillery there, his cavalry scouting well out to the front. Then he leaves, with his staff, and the other commander takes his turn. The Blue commander is given a brief outline of what Red commander have become apparent to his advance guard and reserve since his last disposition and he makes his dispositions and issues the necessary orders accordingly, which are executed by his subordinates.

Then the Red commander takes his turn once more, and so they go, alternately, taking an interesting to take absolute cognisance of the new conditions which confront them and meeting them as best they may, until the problem is fully developed and the object of the exercise is gained. Seldom is the problem continued to a conclusion of hostilities, for the object is not to see who wins, but to illustrate conditions. When the umpires and instructors are ready, the entire body of the participants assembles; the field, with its pins and blocks in their final positions, is uncovered, and a general discussion of the exercise is inaugurated, with criticisms and explanations by the instructors.

Let us take a small problem and follow it to a conclusion. A Red force has been severely worsted in combat, and is, of necessity, in full retreat, shattered in strength and rather demoralized by the defeat. This has all been set forth in the General Situation and Capt. Blank has been designated to command the Red rear guard, to cover the retreat of the broken force to which he belongs. His rear guard consists of two regiments of cavalry and a battery of field artillery.

The enemy is in eager pursuit, and unless he can be checked, will soon overtake, with his fresh reserves, the fleeing enemy. Fleeing is only a fancy word, for bodies of troops are seldom able to retreat at any great pace, and worn, dispirited men cannot move with the celerity of fresh troops, inspired to greater efforts by the flush of victory.

Capt. Blank knows, as an axiom, that time must be gained, that the enemy must be checked, to enable his harried main body to gain a little more distance; each ten minutes that he can delay the enemy means a precious half mile for his general. True, he may gallantly stand his ground and fight until his last man or last cartridge is expended, but when that is over and done, there will remain no rear guard to interpose its buffer. That will not do. He looks at his map, eagerly scanning the winding contours which mark the hills and valleys, and quickly settles upon a nearby wooded crest for his first stand. Then he issues his orders, writing them out for the umpires, although under service conditions they would probably be oral, with a decided snap to them. His time scale, cavalry-at-the-gallop, shows him that the position half a mile away may be reached in two minutes, and the yellow-headed pins gallop to the designated point, under the hand of the umpire.

Blank knows, from the General Situation, how close the pursuing troops were when he started, and his scale shows him how soon they will come up within range, hurrying along the road. At the proper time he opens fire and, naturally, the enemy is forced to halt and deploy, to drive him out with an attack by superior force. Witness how the time again enters into the problem! The pursuing force is twice as strong as his own, four regiments of cavalry. In column of fours, stretched out along the road, the four regiments cover almost three miles. Before the rear of the column can come up, to deploy in line, it must cover that three miles. Three miles times 6 minutes per mile equals 18 minutes gained for the retreating main body. All the time the deployment was in progress Capt. Blank's troops, dismounted, and his artillery were pouring a fire into the enemy, delaying their every movement, and by the time the enemy's deployment was completed, he

...ing, and battery limbered up ...ment, and withdrawn at a time, and ...ing, etc., on the main body, ...ion, and in a few min... which had been left behind, to act ...ment of rear guard to the rear guard, came up ...Blank has so far gained a mile and a ...

...Blank withdrew, mounted up ...ment again, this time striving to ...ear guard, taking advantage of ...ossible to conceal his movements, ...to get to the retreating main body with... the rear guard.

...is to be expected. Blank has foreseen this ...ounted his mounted patrols, at a stretching ...out in every direction, for a mile or more, and ...ese patrols at the first position to watch the enemy ...give him prompt warning of his direction. A mes... ...ceiver saying that the enemy has swept around to ...the north. Another study of the map, lightning quick, ...shows where he may intercept the pursuers, and leaving ...a small force to cover the road, he rides away again to ...the flank, takes position, meets the enemy, forces him ...to deploy, and gains more time, hurrying away to a new ...position before the enemy can inflict any serious dam... ...upon him.

After the exercise is suspended the umpire begins his comments. He will probably commend Blank's methods, but may recommend a closer study of the map, pointing out that Capt. Blank has taken his command up a precipitous bluff, a physically impossible feat, or has blandly forded a stream, impassable except for the bridges, a mile away. It is all in the game.

The most necessary qualifications for the players of the war game are: Understanding of the conditions and situations as presented; decision, quick and accurate, and the clear and proper drawing up of the necessary orders for the movements.

Understanding must naturally include map reading. There is nothing hard about it, but it is necessary that a conventional sign be recognised almost subconsciously, to assist in a visualization of the field, and this can only be acquired by practice, practice, practice.

For locating the positions of the various troops in the exercise and for placing them rapidly, a very ingenious system has been devised by our officers. For instance, when it is desired to show a long column on the march, the various elements of the command are represented by little oblong strips of cardboard, cut exactly to scale, a distinctive color or combination of colors for each branch of the service, pinned one behind another on a long strip of wood, which may be laid on the map intact, covering exactly the proper distance. When it becomes necessary to deploy, to form line to the front, the sections are taken from the strip, one by one, and pinned to the map in their order of reaching the line.

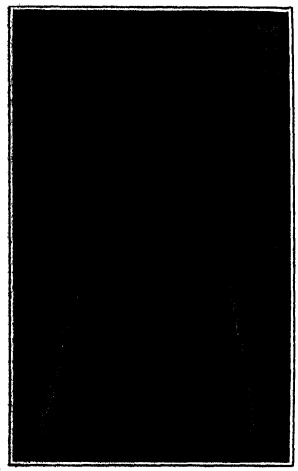
A deployed line of skirmishers, is represented by small beads, strung on wires which may be bent in any shape to conform to the condition of the ground which they are supposed to occupy.

Individual pieces of artillery are indicated by single red-headed pins; a battery by a crimson strip of cardboard. A dummy clock with movable hands is used by each side, the hands being set to show the exact moment of a certain phase of the action. This is shown to the opposing commander, and from this indicated time he must compute the advance that has been made, by his tables, so much a minute for cavalry, artillery and infantry, according to the gait.

A scale, pasted upon flexible linen which may be bent to conform to the twisting of a road, is used to compute marching time and distances, and with other scales on irregular brass plates, time scales and sometimes dividers are the principal instruments of computation.

The days when a general, from a central point, could see his troops in action and direct their movements by sound of bugle, flash of colors, a dashing aide, are past and gone. In the present day of enormously extended lines of advance and attack, the line of battle which formerly may have been three or four miles long, is now extended to a length of from twenty to thirty miles, and the troops in action are sometimes a hundred miles, and the commander-in-chief is perhaps twenty miles to the rear.

But to the house, or tent, which is his headquarters, there runs a network of slender copper wires, reaching to every point where his troops are in position, and a small corps of operators with head receivers clamped on are ever on the alert for the incoming stream of messages. And as fast as they are received, an aide, according to their purport, changes a colored pin a fraction of an inch on the map spread out before the Chief of Staff, and the map shows whether they, the body of



Scales, dummy clock, and indicating devices used in the war game.

troops in question, are intrenched on a hillside, in an orchard, or have forded a stream in the face of opposition.

It is a great game, but it is not a pastime. To a layman, it might appear ridiculous to watch the seriousness and concentration of an earnest class of student officers, poring over a map and aimlessly moving little pins and blocks about its pictured surface. But in the hands of those men the safety of our country lies, and the state of our preparedness for war, with our tiny army. Our army now numbers thousands—these gentlemen play the map game with hundreds of thousands, what we would require in time of war, and they know that such a number is necessary—and strive their mightiest to learn how to hold the enemy in check with our little handful until the volunteers may be trained, which takes months! May the day of sacrifice be deferred!



The Kriegspiel table on which mimic battles are waged.

Where Waste Newspapers Go

WHAT becomes of the thousands upon thousands of newspapers that are discarded by readers on street cars, railroads, and in the homes? The question must naturally obtrude itself on the minds of many in the hurrying throngs to and from business, who note the disorderly litter that collects at terminal stations.

Waste newspapers are used almost exclusively in the manufacture of the cardboard or pasteboard which goes to form the paperboard box in which dressmakers, shoemakers, and department stores generally, deliver dresses, suits, shoes, etc., and one of the largest factories in the United States for the manufacture of this kind of cardboard is located just outside of Philadelphia on the Schuylkill River at Manayunk.

Long trains of freight cars may be seen at Manayunk, any day, loaded with bales of waste newspapers, the collection of many cities, which have been assembled here for conversion into the clean sheets of cardboard that will be used later for fashioning a box fit to hold my lady's gown of dainties chiffon or tulle

The preliminary operation of unpacking the bales of material which have been put together by waste paper dealers is not an agreeable operation to witness As the mixed newspaper refuse is sold by weight, waste paper dealers are not overcareful in the sorting of the material, and tin cans and other heavy materials may be surreptitiously introduced at some stage of the process of packing the small bundles which are turned in by individual collectors of the material

If one can stand the choking dust that arises as bales are opened and sorted by the busy workers in the paperboard factory, and he watches the operation of unpacking, he will note the truly miscellaneous character of the contents of these bales of "waste paper," which include newspapers of morning and afternoon editions with all their embellishments of scareheads in black and red, in company with a miscellaneous assortment of paper material like carnival streamers, harlequin caps, confetti, empty firecrackers, and all the other discarded paper waste of homes, stores, and streets

After a rough preliminary sorting in which the heavier adulterants are removed, the mass of paper is ground to pulp in a special beating and washing engine. The mass is then led over strainers and the odds and ends of tin, bones, wooden toys, iron and woolen material that have escaped the attention of the first sorters are removed. A special furnace is maintained for the incineration of these foreign materials, the ash of which is utilized in other industries It takes a lot of beating, pulping, and washing to transform the heterogeneous mass of mixed papers, which have the appearance of so much useless rubbish and waste, into the clean cardboard material into which it is ultimately fashioned.

The average suit or shoe box has a story of its own, and is not the simple, prosaic article it looks. If my lady who unpacks the container of dainty shoes, slippers or garments, as received from the store, could reconstruct the materials of which the box is composed, she would be more amazed than the subject of a fairy enchantment; for forests have gone to the making of the newspapers which form the substance of the box, the earth has given up clay to its fashioning, and interwoven with it are the streamers, firecracker cases and the various apparelings of many a carnival. Added to all this there might stand revealed many a thrilling story of life's comedy or tragedy as told in the day's news.

An Opening for American Teachers in Germany, due to the war, be pointed out by the American consul at Breslau. Heretofore nearly all the English speaking teachers in German schools and universities, as well as English-speaking tutors and governesses in private families, have been Englishmen and English women. As such persons are now under a ban, there is a splendid opportunity for suitably qualified Americans to take their places.



The new 14-inch gun mounted on our latest dreadnoughts.

Rifles and Mortars

Construction and Operation of High-Velocity Direct-Fire Rifles and Low-Velocity High-Angle Fire Mortars

IF a 1,046-pound shell is fired at Sandy Hook from a 12-inch coast-defense rifle elevated to about eleven degrees, and charged with 280 pounds of powder, it will hit the side of a battleship distant 12,400 yards from the gun. If a shell weighing 825 pounds is fired from one of our 12-inch mortars, elevated to an angle of about 45 degrees, and charged with 58 pounds of powder, the shell will land upon the deck of the same battleship at the same range of 12,400 yards Because of its high velocity, the trajectory, or line of flight, of the shell from the rifle will be very flat, and it will take only about twenty seconds to arrive at the target. Because of the high elevation of the mortar and its low initial velocity of 1,325 feet a second, its shell will describe a parabolic curve of great height, and it will be in the air for over a minute of time Because of its relatively high initial velocity and the relative short time of flight, the 1,000-pound shell would reach the ship with a high remaining velocity and large penetrative energy; in fact, it would be capable at that range of penetrating a thickness of armor equal to the diameter of the shell, or say about twelve inches. The mortar shell, on the other hand, starting with a low velocity and subjected to the retarding effect of the atmosphere for over a minute of time, would reach the ship with a very low velocity, and therefore would be capable of only a limited amount of penetration; nevertheless, its energy would be sufficient to enable it to pass through the protective deck of a battleship and work havoc in its engine room or magazines

The high-velocity, direct fire rifle is sighted directly upon its object, that is to say, the gun pointer maintains the cross wires of the gun telescope directly upon the ship; in other words, he sees what he is firing at The gunners who elevate and traverse the mortars of our coast fortifications, on the other hand, never see their target. They are entirely hidden from the direct vision of the enemy, and usually the mortars and the gun detachments are in deep pits sunk well below the level of the surrounding terrain. The data for the elevation and traversing (movement to right or left on a turntable) of the mortar are worked out by a group of officers who may be located in some protected position at a considerable distance from the gun.

Direct fire is used mainly for naval guns on board ship and for rifles in coast fortifications; but it is used only to a limited extent in artillery work on land. Except in those cases where the Germans, through their universal spy system, were thoroughly acquainted beforehand with the terrain, and were able to place their siege guns in locations, the exact distances of which from the forts to be attacked were accurately known, it is probable that the range was found by firing trial or "range shots" and correcting the errors by observation from some artificial or natural elevation, or from aeroplanes In the defense of harbors by permanent coast fortifications, the distance to the enemy is determined by triangulation from concealed observation points, located at the ends of a lengthy base line, where instrumental observations determine the angles between the base line and the lines to the ship; or else the ship is located by depression finders, such as the Lewis depression finder used in our own coast fortifications, which automatically record the range when the telescope is focused upon the ship.

Direct-fire guns are used mainly for attacking the armored portions of ships or the parapets of fortifications, or bodies of troops in the field—for any form of attack, in fact, in which the gunner can sight directly on the target.

High-angle fire, on the contrary, is directed against the thinner horizontal armor employed on the roofs of turrets, or on the one or more protective decks of a warship. In field operations it is used against the roofs of armored cupolas and the vertical protection of whatever kind, which may be protecting the garrison. In field operations in the open, the 3-inch field pieces use direct fire where it is possible; but because of the concealment, natural and artificial, of the troops in modern fighting, a large part of this attack must be aimed through information given by observers in positions on eminences or in aeroplanes.

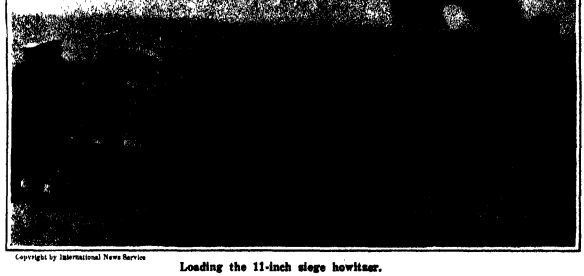
"Direct fire" is used with high-velocity guns elevated to not more than 15 degrees.

"Curved fire" is used with howitzers of low velocity, elevated to not less than 15 degrees.

"High-angle fire" is used with mortars of low velocity, elevated to not less than 45 degrees.

At the present writing it is established that the best armor-piercing shot fired from the most effective direct-fire gun is impotent on the present side armor at ranges consequent on angles of elevation about fifteen degrees. The velocity is so greatly reduced by the resistance of the air that the remaining momentum of the projectile merely serves to shatter it helplessly against the heavy side armor of the target. Direct fire has today a sure limitation of 15 degrees, and will have for some time to come. The limiting angle for indirect fire or mortar fire is likewise restricted, but from a very different cause.

At angles of elevation



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Loading the 11-inch siege howitzer.



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The French (Schneider) semi-mobile 11-inch siege howitzer.

...range of sight becomes so great ... and this marks the limit for ... range and mortar fire. There are other considerations involved in the strength of carriage and ... of sight above this angle, but these are subordinate to the unavoidable objection of excessive time of flight.

Of course, it is understood that to make a hit, it is essential that moving target and flying projectile arrive at the same spot at the same instant. In firing at a maneuvering battleship the element of time of flight thus becomes a most important factor, and it will be readily admitted that the time the projectile is in the air should not exceed one minute. By changing course and rate of speed, the commander of a maneuvering ship, in such a long interval of time as this, can readily place her at other than the predicted or anticipated point where she is expected to be when the shot strikes. This limit points, at the outer range, to an angle of projection not exceeding 65 degrees, since at this angle it takes the projectile over a minute to perform its path of flight.

It is a peculiar coincidence that with limiting restrictions so widely divergent, the scope of angles of projection is about the same. The total change in elevation for direct fire is limited to 15 degrees, and that for mortar fire to 20 degrees. These limitations of the upper angle thus prescribed place a great restriction on the attainable range. On this account it has been necessary to resort in mortar fire to what are called "zones." It is, of course, essential to cover every yard of range between the outermost and innermost limits of fire.

At a maximum velocity, within the power of the gun, behind a given projectile, the maximum range is attained at 45 degrees, but the minimum is not attained at 65 degrees. The only way to get less range after this angle is arrived at is either to reduce the powder charge or increase the weight of the projectile, or both.

Since the longest ranges are of little value, on account of the inherent inaccuracies, it was decided in Uncle Sam's service to build a mortar only strong enough to carry the heaviest projectiles to moderate ranges. A comparatively light projectile was designed for the outermost zone. With this projectile a certain portion of the total range is covered. The limits of this lighter projectile of 824 pounds weight are between a maximum of about 12,400 yards for 45 degrees, to a minimum of about 8,700 yards at 65 degrees elevation.

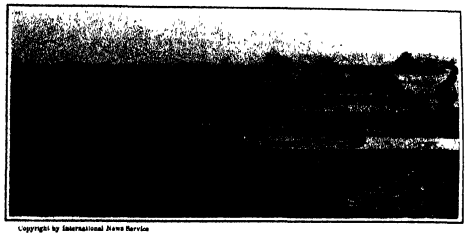
With our latest mortars, of greater length and using a sharper nosed projectile, an extreme range of 19,000 yards has been reached. These are being emplaced at Panama.

An approaching battleship is fired upon by mortars at the outermost range, and finally arrives at safe anchorage on account of the limiting angle of 65 degrees elevation, which results in the shortest possible range for the mortar under the restriction formerly adverted to. Alive to this situation, the mortar man employs a heavier projectile of 1,040 pounds weight, the same as that used in a 12-inch direct-fire gun; and so reduces his powder charge as to attain the same or but slightly greater range at his best angle of 45 degrees with this projectile than was previously attained at 65 degrees elevation with the lighter one. He thus establishes a second zone of fire that will just join the enemy once more arrives at the angle of safe anchorage, or it may be short, of 65 degrees. Once again the powder charge is increased so that the angle of 45 degrees will result in range but little greater than was previously attained at 65 degrees. So on, by successive reductions of charge, the range is shortened with successive zones of fire till the minimum limit is reached.

The limiting range is for an angle of 65 degrees with the smallest powder charge that will result in stability of flight. Stability of flight means that in spite of the low limit of velocity and the limiting twist of the riding of the bore of the mortar, for high velocity, the gyroscopic action of the elongated projectile shall still be sufficient to keep it steady in flight. The wobbling of a spinning top that is dying out is an illustration of the effect that a too low velocity might have on a projectile fired from a gun. There is danger of the projectile "tumbling" end over end.

To give the mortar crew time to change the power charge from one zone to the next, a certain "overlap" of zones is provided. The next lower powder charge is so prescribed that at 45 degrees elevation the range will be somewhat greater than the charge next above at 65 degrees. To meet all these requirements, eight zones of fire are prescribed and the conditions met are here with illustrated.

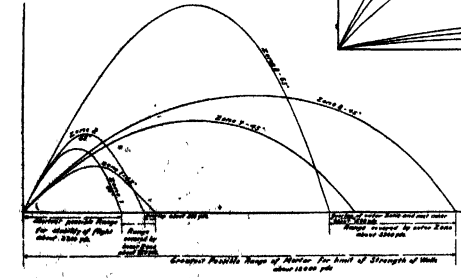
With such complications involved, and in consideration of the fact that the mortar crew is hid behind protecting parapets and does not even see the moving target attacked, results are marvelous. A mortar crew in recent firings obtained seven hits in eight shots at a range approximately 10,000 yards, or nearly six miles. That all difficulties have been met and overcome, in the construction of a range table and adequate method of correction for abnormal conditions of atmosphere, wind, and travel of the target, that will give a mortar crew a fair chance of a hit, is an achievement in which the servants of Uncle Sam, who are responsible for this accomplishment, find a solid degree of satisfaction. In no foreign country has so great a measure of success been attained by the methods of mortar fire.



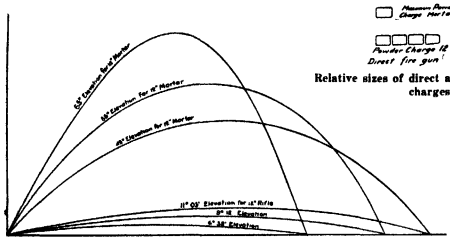
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Note the siege railway at the rear for bringing up the ammunition.

A battery of French howitzers emplaced on concrete platforms in an open field near Verdun.



Zones of fire of mortar batteries.

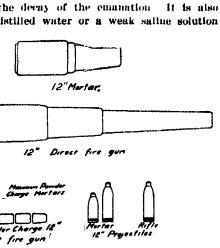


Relative angles of elevation and trajectories of shells from 12-inch rifles and 12-inch mortars.

Package for Parcel Post.—A patent, No. 1,107,330, for the invention of Ira A. Milliron of New York city, has issued for a parcel post package in which the cushioning effect is secured with little weight by utilizing air cushions in the form of wrappers having a number of inflatable compartments and enclosed in a container.

Radium Water

WITH the discovery of the marvelous physical properties of radium, it seemed to be expected by the general public, somewhat irrationally, that its medical properties would be equally marvelous. The consequence has been that a number of hasty claims on behalf of the curative properties of radium have been made which have been subsequently abandoned, and there is now some danger that the public, finding itself repeatedly misled, will prove itself skeptical of results which have undoubtedly been achieved. But for some time work of a perfectly sane, sober, scientific nature has been carried out by the Radium Institute of London and its report, published in the *British Medical Journal*, contains results of a sufficiently startling, if not sensational, character. The apparatus employed in treating different diseases is of various types, consisting of flat varnished applicators, rectangular, square, and circular, the superficial area ranging from 0.7 square centimeter to 28 square centimeters. They are made in three strengths; full strength containing an amount of radium sulphate equivalent to 10 milligrammes of radium bromide to each square centimeter, and half-strength and quarter-strength. The smallest applicator contains 7 milligrammes and the largest 150 milligrammes. Capillary glass tubes filled with radium sulphate closely packed are used for insertion into openings in the body, in cases where the diseased area could not be reached in any other way, their length varies from 2 to 4 centimeters and their diameters from 0.2 to 0.3 centimeter. The radium emanation is sometimes collected in glass tubes or metal containers and used with appropriate screens, exactly as the radium salts are used, due regard being paid to the gradual fall in radio-activity resulting from the decay of the emanation. It is also dissolved in distilled water or a weak saline solution and administered by drinking or injection. The radium water is prepared by bubbling radium emanation through distilled water, which is then slowly drawn off into bottles. The bottles are sealed and carefully packed for delivery to all parts of the kingdom. The apparatus at the Institute is designed to give solutions with an activity from 1 to 2 millicuries per liter, an activity much greater than the best of the radioactive water from natural sources.



Relative sizes of direct and indirect-fire guns, powder charges and shells.

As a drink radium water would prove an expensive luxury, since a very moderate sized bottle costs two and a half dollars.

The present writer, on being asked to sample the radium water did so before learning its cost, and afterward estimated that he had drunk about a dollar's worth.

Radium water has the flat taste one associates with distilled water, together with a curious faint salty flavor, and its effect, so far as the writer's experience goes, is to render one extremely sleepy for the rest of the day.

For these reasons alone it is not probable that radium water will ever rival a John Collins or any similar preparation as a beverage, even for millionaires. Considered as a medicine one "dose" is of no use. It has to be taken continuously for some time, and the patient who starts taking radium water usually has to consume about one hundred dollars' worth before its beneficial effects are perceived.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

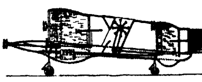
Pertaining to Apparel.

FOOT REST.—G. L. TUFTS, Anahuac, Texas. This rest is especially adapted for supporting the foot during shoe polishing, and suitable for use in shops or in other places, wherein a support is provided, having means for clamping the shoe to the support, and a stand with which the support is so connected that it may be adjusted to the proper height for engagement of the shoe by the grips.

SHOE LACE TIP.—C. R. JEFFORDS, 19 Union Park Ave., Jamaica, New York, N. Y. This invention provides a tip for shoe and other lacings which is more firmly attached to the lacings than other tips of the same class, and which has the additional function of serving as a fastening or attaching device for the free end of the lacing.

Pertaining to Aviation.

AEROPLANE.—V. N. ROSATO, 166 Nepperhan Ave., Yonkers, N. Y. The inventor provides an aeroplane body having longitudinally arranged passageways for air, and such passageways are controlled by certain pivoted doors or shutters for the purpose of increasing



AEROPLANE

the safety of the device in case of accident. He also provides an upwardly inclined passageway through the aeroplane body and mounts therein a wheel having geared connections with an auxiliary propeller for the purpose of steadying the machine in ordinary flight.

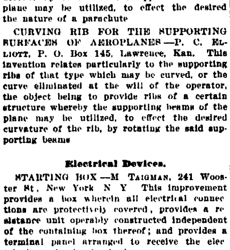
SAFETY AEROPLANE.—T. S. HAYNES, care of Seim and Austin, Bay City, Tex. The invention provides a means whereby the aviator may detach himself from the main or heavier portion of the construction and be sent to the earth in safety while seated on the usual seat of the machine and supported for gradual descent by means of the upper of the two plane may be utilized, to effect the desired the nature of a parachute.

CURVING RIB FOR THE SUPPORTING SURFACES OF AEROPLANES.—P. C. ELLIOTT, P. O. Box 145, Lawrence, Kan. This invention relates particularly to the supporting ribs of that type which may be curved, or the curve eliminated at the will of the operator, the object being to provide ribs of a certain structure whereby the supporting beams of the plane may be utilized, to effect the desired curvature of the rib, by rotating the said supporting beams.

Electrical Devices.

STARTING BOX.—M. TAIGMAN, 241 Wooster St., New York, N. Y. This improvement provides a box wherein all electrical connections are protectively covered, provides a resistance unit operably constructed independent of the containing box thereof; and provides a terminal panel arranged to receive the electrical supply circular leads.

BRUSH HOLDER.—A. N. SAMMARONE, 18 Cuyahoga St., Akron, Ohio. The invention has for its object to provide a device especially adapted for holding commutator brushes of electrical apparatus, wherein a holder is provided formed from two pieces of stamped



BRUSH HOLDER

metal, folded or bent in such manner as to provide a substantially box-shaped holder having ways or guides to support the ordinary carbon brush for adjustment, and wherein resilient means is also provided, adapted to engage the brush to press it toward the face of the commutator.

ELECTRIC CLOCK.—L. CESF, 49 Maiden Lane, New York, N. Y. In order to insure great accuracy and to require a minimum amount of electric current for actuating the clock, use is made of an auxiliary spring driving device placed under tension by the action of the solenoid and adapted to drive the train of gear wheels of the time mechanism during the time the core of the solenoid returns to normal position.

SYSTEM OF ELECTRICAL SUPPLY.—A. H. HEYROTH, Hawarden, Mont. This invention relates generally to systems of electrical supply, and more particularly to means for placing a generator into or out of co-operative relation with the storage battery, the condition determining the operation of the said terms being the E. M. F. of the generator.

WINDMILL POWER PLANT.—A. H. HEYROTH, Hawarden, Mont. This invention relates generally to windmill power plants, and is particularly directed to methods of control in the event that the wind varies its velocity or rises to such a velocity that the voltage generated becomes excessive.

METHOD OF OPERATING ELECTROMAGNETIC STRIKING TOOLS BY MEANS OF ALTERNATING CURRENT.—L. SCHÜLER, Berlin-Lichterfelde-West, Germany. This invention relates to a new method of operating electromagnetic striking tools by means of alternating current with the aid of synchronous interrupters, whereby a satisfactory working of the striking tool is obtained, while all sparks during the interruption of the current are avoided.

Of Interest to Farmers.

BEET HARVESTER.—H. B. SCHRADER, Sterling, Colo. This invention has reference more particularly to a harvester provided with a beet-top cutting mechanism. The purpose of the improvement is to provide a simple and inexpensive beet harvester, strong in construction and having an adjustable top-cutting mechanism.

HAY RACK.—E. H. GAGNON, 116 House Bldg., Pittsburgh, Pa. An object here is to provide an improved structure which may be readily placed in position upon the wagon and readily and easily removed. Another object is to provide a structure which is comparatively light but strong, and adapted to receive loads of different material in addition to hay.

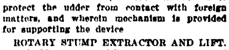
SANITARY MILK PROTECTOR.—C. E. NARY, Georgetown, Ind. The invention provides a device for connection with a cow, and so arranged that it may be supported inclosing the udder of the cow, in such manner as to protect the udder from contact with foreign matters, and wherein mechanism is provided for supporting the device.

ROTARY STUMP EXTRACTOR AND LIFT.—A. L. MOORE, care of Pan-American Land and Lumber Co., P. O. Box 910, New Orleans, La. The purpose here is to provide an improved machine whereby to sever the roots of a stump and extract the stump in a manner to produce a minimum disturbance of the ground, so that the ground is left substantially intact for cultivation.

BOOT FASTENER FOR DRILLS.—T. C. GARRITY, Lincoln, Kan. This invention relates to grain drills generally, and more particularly to a scraper attachment for disk furrow openers. It provides a novel means for arranging and attaching a scraper to the disk, whereby the scraper may be adjusted to work against the disk, and to take up wear as the scraper or disk becomes worn.

SILAGE HANDLING APPARATUS.—J. L. BEANE, Legrand, Iowa. This apparatus is capable of installation in connection with any silo, wherein a carrier is arranged to travel from the silo to the place of disposal, and wherein the carrier is arranged in such manner that the load may be dumped whenever desired, and wherein tripping mechanism is provided for operating the dumping mechanism of the carrier, the said mechanism being so arranged that it may be operated to dump the carrier at any point.

CHECK ROWER STAKE.—D. M. LUSE, Rockwell City, Iowa. The invention is an improvement in check rower stakes, and has for its object to provide a stake of the character



CHECK ROWER STAKE.

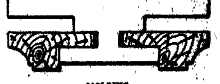
specified, for supporting the end of the check wire, and wherein means is provided for engagement by the check wire, and other means for supporting the said engaging means for movement laterally with respect to the wire.

CLAMP.—A. J. BANKS, Montour, Iowa. The invention refers to wire fence construction, where the wire mesh is tightly stretched between fence posts and secured thereto, this requiring that means for quick and easy engagement with said mesh must be provided and which means are connected with the stretching tackle or apparatus, and it was in order to effect such engagement and disengagement in an expeditious and easy manner that the invention was conceived, this constituting the main object of the invention.

Of General Interest.

GEODETICAL UNIVERSAL INSTRUMENT.—H. R. VON WINTERHALDER, Klosterneuburg, near Vienna, Austria-Hungary. The telescope carrier is constructed as a diopter, that is to say, it comprises two sights connected by a rule detached from the other parts of the instrument. Therefore the instrument can be used for measuring horizontal and vertical angles, as well as for [illegible] distances, and also for work on the [illegible] table.

MOLDING.—W. [illegible], [illegible] ley St., Memphis, Tenn. In this patent the invention relates to improvements in molding, and has for an object to provide an improved structure for receiving wall boards or materials of similar nature. Another object in view is to provide a molding which will receive



MOLDING.

wall boards or paneling and allow for ample expansion while clamping the boards firmly in place. The molding may be made in slightly different ways so as to accommodate different places in the building, as, for instance, the ordinary side wall or ceiling and the corner.

EXHIBITING DEVICE.—E. P. JARVIS, care of Aloytious F. Lotz, care of New York Stove Mercantile Co., Beloit, Kan. This device comprises a sign board or plate having a row of illuminating devices along its top and bottom, and bearing on its front face the things to be exhibited. These things may of course be letters or pictures, or any form of representation which is useful for the advertiser's purpose.

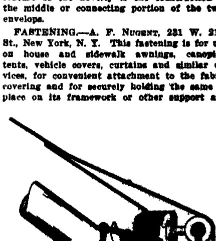
SIDEWALK AIR AND LIGHT GRATING.—E. BERSON, 1113 Van Alst Ave., Astoria, New York, N. Y. The general objects of the invention are to improve and simplify the construction of gratings so as to be reliable and efficient in use, extremely simple and durable. The invention relates to gratings especially for use in sidewalks for permitting light and air to pass into basements and cellars.

NON-REFILLABLE BOTTLE.—B. F. KLAAS, care of J. P. Ryan, 158 E. 36th St., New York, N. Y. This bottle or vessel, after its contents have been dispensed, cannot be refilled without destroying the bottle, thus serving as an effective means for preventing the sale of liquids or the like unscrupulously.

SPOOL.—J. C. HOFFMAN, 10 Jones St., Bronx, New York, N. Y. The invention relates to spools, and has reference more particularly to spools made of pasteboard; and the object thereof is to provide a simple, strong, and inexpensive spool in which the flanges and the central tubular portion of the spool are rigidly connected.

DUPLEX ENVELOP.—A. MILLER, Albemarle, N. C. Mr. Miller's invention is an improvement in the small duplex or "twin" envelops designed particularly for use in churches to receive offerings for different purposes. The feature of the novelty is the construction of the middle or connecting portion of the twin envelops.

FASTENING.—A. F. NUGENT, 231 W. 21st St., New York, N. Y. This fastening is for use on house and sidewalk awnings, canopies, tents, vehicle covers, curtains and similar devices, for convenient attachment to the fabric covering and for securely holding the same in place on its framework or other support and



FABRIC COVERING FASTENER.

without the use of staples, rings, grommets, hooks, straps and buckles, snap hooks, lacings, tying bands and the like, thus allowing the workmen to securely fasten the fabric coverings in place, especially in extremely cold weather.

KODAK SUPPORT.—L. F. [illegible], [illegible] Decatur Ave., Bronx, New York, N. Y. This improvement has reference to photography and has particular reference to kodak appliances. Among the objects of the invention is the provision of a simple, reliable, and satisfactory means for connecting a vest pocket kodak to a tripod for the usual purposes.

COLLAPSIBLE SHIPPING CRATE.—[illegible] MORGAN, [illegible] Riverside Drive, [illegible], N. Y. This invention is [illegible] especially for use in [illegible] adapted for other purposes [illegible]

are to be [illegible] [illegible]

DETACHABLE CONNECTION FOR BUILDING BLOCKS.—[illegible] This invention relates to [illegible] able connections, and [illegible] object to provide an [illegible] structure whereby the [illegible] connected up quickly and easily and [illegible] manner as to retain [illegible]

WATERPROOF CONCRETE BUILDING BLOCK.—A. D. WILSON, [illegible], Brooklyn, N. Y. This invention improves the construction of building blocks in such a manner as to make them both strong and light with respect to mass. It provides a concrete building unit having associated therewith, as a permanent part thereof, a reinforcing [illegible] rib of wood or material of any character adapted to be used as a means to support or connect laths or other building material.

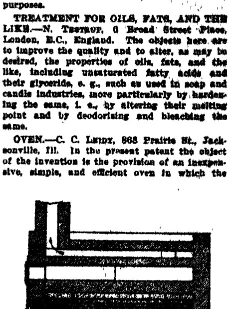
NON SPILLABLE SHIP TABLE.—F. W. KEYMER, 610 Bergen St., Brooklyn, N. Y., and G. I. BROWN, Florida, N. Y. In the present patent the inventor provides a table for ships formed with a top arranged on movable supports, which in turn are controlled by weights, whereby as the ship tosses the weights will be actuated for maintaining the top of the table in a horizontal or substantially horizontal position.

WATER SYSTEM.—T. C. WILKES and S. E. PHILLIPS. Address the former, Box 285, Jackson, Mich. The object of this improvement is to provide a system so arranged that water may be drawn from the main at all times regardless of temperature conditions, and regardless of whether or not the usual conduit pipe is frozen.

COMBINED BLOTTER HOLDER AND HAND REST.—A. E. HOSMER, Bay City, Mich. The invention is a hand-rest provided with means for holding an ordinary blotter and particularly adapted for use of bookkeepers, but also serviceable for general use of writers. The ruler possesses the desired flexibility to permit its bending in its use for blotting purposes.

TREATMENT FOR OILS, FATS, AND THE LIKE.—N. TESTRUP, 6 Broad Street Place, London, E.C., England. The objects here are to improve the quality and to alter, as may be desired, the properties of oils, fats, and the like, including unsaturated fatty acids and their glycerids, e. g., such as used in soap and candle industries, more particularly by hardening the same, i. e., by altering their melting point and by deodorizing and bleaching the same.

OVEN.—C. C. LEIDY, 863 Prairie St., Jacksonville, Ill. In the present patent the object of the invention is the provision of an inexpensive, simple, and efficient oven in which the



OVEN.

contraction and expansion of the oven body structure is balanced by a granulated non-conducting material placed within the body structure of the oven.

ANIMAL TRAP.—J. E. RUBY, 442 Highland Ave., Indianapolis, Ind. The invention has reference to animal traps of a kind suitable for killing rats and mice. More particularly the improvement comprehends a trap of this kind, in which the trigger is rendered especially sensitive for enabling animals to actuate the trigger.

INDESTRUCTIBLE AND COLLAPSIBLE DRINKING CUP.—F. F. JACKSON, 176 Boyd St., Stapleton, N. Y., N. Y. The object of the invention is comprehended in providing a cup to be pressed or molded of rubber or other resilient material or composition, to lie flat and thereby be rendered especially adaptable to be carried in one's pocket, and also reinforced at its edges to assist in its assumption of a flat position as well as to provide for increasing wearing qualities.

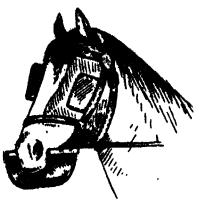
COMPOSITION OF MATTER.—C. [illegible], care of Fluoride Mfg. Co., [illegible], N. Y. The ingredients of this matter are thoroughly mingled and mixed together while in a dry state, to form an impalpable powder which can be readily put up in cans or bags so as to be ready for use whenever desired, the composition keeping unaltered for any reasonable length of time.

DIAPHRAGM FOR ACOUSTIC [illegible] DUCERS.—F. W. [illegible], Bay City, [illegible]. This invention provides a diaphragm [illegible]

...chanics of burrs or other tools. The improved handpiece is made up of comparatively few parts and comprises a pair of spring jaws which may be readily opened or closed by turning a knurled nut.

ADJUSTABLE HAND STAMP.—W. DOWLING, 3606 Grand Central Station, New York, N. Y. The invention provides a hand stamp with an adjustable frame for supporting a plurality of removable or interchangeable stamp elements whereby the device may be lengthened or shortened according to the length of the word, name, or legend to be stamped or printed.

HORSE PROTECTOR.—J. W. NILSSON, Balfour, N. D. This invention provides a device for effectually protecting a horse's mouth from attacks by bot-flies, at the same time allowing normal breathing of the animal. It also



HORSE PROTECTOR.

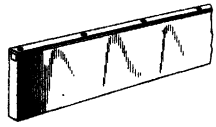
provides for a protector so constructed and arranged that when in place on an animal, the latter may eat or drink without the necessity of removing the protector.

Hardware and Tools.

LOCK FOR HAND BAGS.—J. FARTMANN, 778 Prospect Ave., Bronx, N. Y. A stud is mounted on a frame member of the bag, this stud having bearings in which the terminals of a handle are journaled, there being a tongue secured to the companion frame member, for movement in a recess in the stud, so that the terminal of a bolt member, disposed for moving in a hollow portion of the handle and in a guideway in the stud, may move into an opening in the tongue to hold the tongue relatively to the stud and with the frame members together.

ELEVATOR WRENCH.—G. F. LEBUS, Electra, Texas. This inventor provides a device for use in rotary drilling machines for supporting the drill pipe and for holding it from rotation during the releasing of the several joints of the pipe when it is necessary to withdraw the drill from the well hole.

STRAIGHT EDGE.—G. W. PENN, 2112 Browder St., Dallas, Tex. The purpose in this case is to provide a tool especially adapted for paper hangers' use, wherein mechanism is pro-



STRAIGHT EDGE.

vided in connection with the straight edge, for compensating for warping or bending, to permit the edge to be returned to its original straight condition With the present invention the straight edge will not warp so readily as the usual construction.

TONGS.—J. H. KUHNS, Tulsa, Okla. Address Cary & Spillers, same place. The object here is to provide tongs wherein an operating lever or handle is provided with which cooperates a curved short lever or gripping jaw, the tongs being especially adapted for use with pipe or other articles of circular cross section, and wherein the article may be quickly grasped or released.

PIPE CUTTER.—J. T. BODKIN, care of City Water Co., Chattanooga, Tenn. The invention relates to devices for cutting pipe, more especially water pipe or other large pipe which is in use, for the purpose of making connections, etc. An object is to provide a device the use of which will save time, labor, and expense in cutting pipe.

EXTENSION LADDER.—P. E. JOHNSON and E. ANDERSON, 302½ 14th St., Brooklyn, N. Y. The invention provides a ladder capable of being extended in a very simple and secure manner. To accomplish this, use is made of extension side pieces connecting with each other by adjustable rungs or steps and adjustably secured to the main side pieces of the ladder.

SURGICAL INSTRUMENT.—N. C. MOSES, care of Emergency Hospital, Hidora, Iowa. The invention relates particularly to instruments for obstetrical purposes; and it is so constructed that the component parts thereof can be readily put together and readily separated from one another according to the necessities of actual practice; and when assembled they can be locked in any desired position of adjustment by the operator using the same.

ROCK DRILL.—M. SMITH, Bisbee, Ariz. The improvement refers to rock drills, and more particularly to the drill bits used in rock drilling and of that type provided with a side inlet through which either air or water, or both, may be introduced under atmospheric or forced pressure.

COMBINATION TOOL.—L. B SMITH, College Place, Wash. This invention relates to a combination tool involving primarily a wagon or buggy wrench of novel form adjustable to adapt it to nuts or burrs of different sizes Associated with the shanks of the wrench in practice, and co-acting therewith, are formed different tools.

Heating and Lighting.

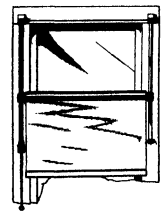
GASOLINE LIGHTER.—C. F. HOOPER, care of Hoofer Novelty Co., 324 Division St., Spokane, Wash. This device is capable of being carried in the pocket and the wick may be ignited by means of a spark struck from a body when abraded by steel, and wherein the movement of a single element extends the wick, strikes a stream of sparks in the direction of the wick, igniting the same, and wherein the wick when not in use is retained in a closed receptacle.

SAFETY EXTINGUISHER FOR LAMPS.—F. KRICH, 554 E. 158th St., Bronx, New York, N. Y. This extinguisher is for lamps burning oil, petroleum and like liquids, and is arranged to automatically extinguish the burner flame in case the lamp is upset, to allow of carrying the lighted lamp about by a person without automatically extinguishing the burning flame, but in case the person carrying the lighted lamp stumbles and loses hold on the lamp, then the flame is automatically extinguished.

Household Utilities.

SALT SHAKER.—A. MENDELSON, 482 Marcy Ave., Brooklyn, N. Y This salt shaker prevents caking or lumping of salt within the cellar and secures a free discharge of the salt, and also provides for the return of any salt that may accumulate upon the outer face of the discharge plate.

SHADE HANGER.—W TROJANOSKI, Patchogue, N. Y. The shade holder has two vertical guide-bars spaced apart, around each of which there is slidably disposed a guide member having a shade bracket, a cord being secured to one of the guide members, the cord passing over a member at the top of the guide bar on which the guide member is mounted and then over a member at the top of the other guide bar, a second cord being secured to the other



SHADE HANGER.

guide member and passing over a member at the top of the last named guide bar The ends of these cords pass between clamp members for holding them with the guide members and brackets at predetermined heights In the brackets there are recesses for the ends of the shaft of the shade roller and means provide for preventing the longitudinal movement of the roller relatively to the brackets

TRAY HOLDING ATTACHMENT FOR BEDSTEADS.—S. A. BERCHIE, Box 325, San Marcos, Tex. This invention includes one or more shelves or trays adapted to be swung over a bed for the purpose of bringing food, drink, or other article into proximity to a patient The trays are also adapted for vertical adjustment, and the vertical rod in which they are supported is secured to a bedpost detachably.

PERCOLATOR.—P. FOSS and C. ARCHAMBAULT, Sylvan Lake, Alberta, Canada. This invention provides a percolator which can be manufactured in different forms, sizes and styles, by means of which infusions of varying degrees of strength can be prepared from tea, coffee, and other substances, with extreme rapidity, with employment of a minimum heat, which is well adapted for use by hunters, campers, prospectors and the like, as well as in the household.

BROOM.—H. J. STRUVE, care of The Deshler Broom Factory, Deshler, Neb. This invention relates more particularly to the long whisk brooms in barber shops and like places. The long fibers in these brooms do not properly reinforce one another and the strain exerted, due to their length, results in the fibers breaking off at the rear ends. Besides, the fibers do not offer the proper resistance for brushing. The present invention overcomes the stated defects.

Machines and Mechanical Devices.

FLEXIBLE COUPLING.—W. J. FRANCER, New Brunswick, N. J The object of this inventor is to provide a coupling arranged to insure the proper transmission of power from one shaft to another, even should such coupled shafts be out of line or out of center, to reduce the wear of the parts of the coupling to a minimum and to allow convenient replacing of worn out or broken flat springs or shims without requiring renewing of the keepers of the flexible connections

HAND FIREARM.—M NAVARRO and E NAVARRO, Amiras 2, La Piedad, Mexico. The invention pertains to hand firearms of the Luger type, in which use is made of the recoil to render the firearm automatic as to ejecting shells and reloading It provides improve-



HAND FIREARM

ments in hand firearms of the above type whereby the firing may be produced periodically on the user pressing the trigger or the firing may be rendered continuous until all or a desired number of cartridges have been fired

SHIP'S ENGINE ROOM SIGNAL.—O K BOJSTRAND, 179 Carroll St., Brooklyn, N. Y This inventor provides a signal, embodying indicator instruments and a third member operatively connected with both of the first-mentioned instruments to disclose by the operation of the machinery if the directions transmitted through the signal instruments are put into effect; provides means for disclosing by the use of said instruments the condition of the machinery of the vessel; and simplifies the construction of the signal mechanism and installation.

PUMP.—J. E WEAVER, Box 272, Twin Falls, Idaho. This invention relates more particularly to balanced compound pumps of the reciprocating type provided with transmitting plungers and swinging, reciprocating pump members It provides a pump in which the power required to pump liquid is reduced to a minimum by balancing the moving parts of the pump

OILER.—F. W. FLAVIN, Naples, S. D The oiler is for use with crank or wrist boxes, or in any other position where it is desired to feed lubricant by force to a bearing or the like, wherein a container is provided for connection with the bearing or other part to be oiled and other mechanism operated by the moving of the rotating element for feeding the lubricant

BRICK CLEANING MACHINE.—J. O. SWISHER, 615 Rosselle St., Jacksonville, Fla The invention provides a machine especially adapted for removing mortar and the like from bricks to prepare them for reuse, and having mechanism for thoroughly cleaning the entire surface of the brick, and for finally discharging the brick in condition to be used again.

APERTURE GATE.—A. A. TURNER, Round Beach, Conn This invention relates to attachments for moving picture machines, and particularly to that part known as an aperture gate, and has for an object to provide an improved structure for use in connection with films provided with a plurality of rows of pictures

UNIVERSAL STONEWORKING MACHINE.—O. BAUER, 681 E 29th St., Brooklyn, N. Y. Among the objects of the invention is the provision of an attachment for an ordinary polishing machine whereby the grinding wheel may be adjusted vertically simultaneously with the usual adjustments of the radius arms of the machine.

STAMP FEEDING MECHANISM.—J. IBARRA, Habana, Cuba. This invention provides mechanism having means for varying the speed of the feed of the stamps; provides a machine arranged to readily effect the duplex action; and provides adjustments for regulating the speed and the feed, access to which adjustments is easily and readily obtained.

CONCENTRATOR.—H P MCINTIRE, 445 S. 5th Ave., Tucson, Ariz This device is for use in concentrating ores and is cheap to manufacture. An object of the inventor is to provide a device in which a great economy of water is effected, and having a large capacity in proportion to its size. The device is of a portable nature

CEMENT TILE MAKING MACHINE.—C. F. R KUETER and W GILLARD. Address the latter, Box 624, Stratford, Canada The object of the invention is to devise a machine in which all manual labor will be dispensed with in removing the tile from the mold to the receiving table and the output thereof materially in-

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...anesthetic apparatus of novel construction, which is simple in construction, inexpensive to manufacture, and comparatively durable in use, and which may be conveniently carried in the hand from one point to another, especially a medical practitioner, and superintending qualities in regulating the dose administered, another important object being to provide a device of this character which is practically automatic, whereupon mica diaphragms are of very short life because of their intimated exposure.

ANESTHETICON SLIDE CARRIER.—E. A. ARMSTRONG, 1360 Broadway, N. Y., N. Y. The invention provides a slide having a movable member for use in conjunction with means provided in the carrier for moving said member; carrying a carrier having a plurality of pockets for holding slides, and operative means in each of said pockets for operating said movable members; and provides a carrier having operating means of the nature mentioned, furnished with manually operable means for actuating the same.

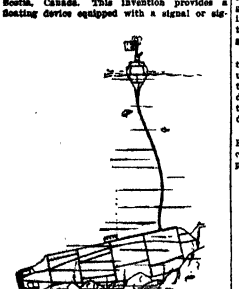
CHLOROFORMER.—J. S. OLIVA, Maximo Gomez No. 3 Regla-Habana, Cuba. The object in this case is to provide a device which is sanitary, as it can be easily taken apart and sterilized, which can be quickly and easily attached and removed from the patient, in which



CHLOROFORMER.

the amount of anesthetic administered can be easily regulated, and in which the anesthetic before being administered to the patient is spread over a large area to facilitate the evaporation of the same.

SIGNAL FOR SUBMARINE VESSELS.—F. A. LOWNDES, 8 Campbell Road, Halifax, Nova Scotia, Canada. This invention provides a floating device equipped with a signal or sig-



SIGNAL FOR SUBMARINE VESSELS.

nals operable from a station within a submerged vessel; provides means for liberating at will said device; provides a variety of signals carried by said device and operable from within the hull of the submerged vessel; provides suitable devices for establishing communication with the inmates of the submerged vessel; provides means for supplying a submerged vessel with atmospheric air; and provides means for elevating a submerged vessel or for assisting in the elevation thereof.

SMOKE AND FUME FILTER.—E. H. GAGNON, 116 House Bldg., Pittsburgh, Pa. This invention has reference to improvements in devices for cleaning and removing various substances from smoke fumes and the like, and particularly to devices for filtering and cleaning the smoke and fumes from smelters and other similar devices.

SEQUENCE.—H. W. STOLTENBERG, 824 17th St., Brooklyn, N. Y. The hooks in use at present for counting purposes have several objectionable features. To obviate these, Mr. Stoltenberg provides a hook which is practically unbreakable, and constructed by the rough usage to which it is subjected, and which is adapted to give quick, certain blows and relieve the strain on the operating thumb due to jerking caused by hard strokes.

CENTRAL HANDPIECE.—A. CARPENTER, care Supreme Dental Supply Company, Chemical Building, Spokane, Wash. Mr. Campbell has invented an improved dental handpiece adapted for use in connection with dental engines. The construction is such that it may be adjusted quickly for attaching or removing burs,

LEGAL NOTICES

PATENTS

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READ THIS COLUMN CAREFULLY You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture those goods write us by number, giving you the name and address of the party desiring this information. There is no charge for this service. *In every case it is necessary to give the number of the inquiry.* Where manufacturers do not respond promptly the inquiry may be repeated
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Inquiry No 9398 Wanted the name and address of a manufacturer of a machine to print and label lead pencils and pen-holders

Inquiry No 9399 Wanted the name and address of workers in ornamental polished stone

Inquiry No 9400 Wanted to buy an insoluble, non-fusible and opaque plastic material to be used in the moulds for manufacturing tobacco pipes of special kind

Inquiry No 9401 Wanted the name and address of the owner of a second hand aeroplane motor from 30 to 50 H.P

Inquiry No 9402 Wanted the name and address of a manufacturer who can make a tin toy

Inquiry No 9403 Wanted the name and address of a glass manufacturer who can blow a small glass article to order.

Inquiry No 9404. Wanted the name and address of a manufacturer of a tool for cutting nicks in plate glass used for name plates and house numbers

Inquiry No 9405 Wanted the name and address of a manufacturer who is able to make an attachable eyelet, aluminum or celluloid through which a snap fastener would work.

Inquiry No 9406 Wanted the name and address of a manufacturer who can supply insole material in rolls The material seems to be a cheap leather compound and attached to a canvas bottom

Inquiry No 9407 Wanted the name and address of some patented mechanical device which saves money or time or both, which if properly handled will bring a large demand. It must not be too expensive. It may be electrical as well as mechanical A first class article desired

Inquiry No 9408 Wanted the name and address of a manufacturer or distributor of a machine which will clean both single and double burlap bags, especially heavy bags

Inquiry No 9409 Wanted to secure a patented device which can be manufactured at small cost and around which a good business could be built

Inquiry No 9410 Wanted the name and address of manufacturers of "Scuffer Shoes



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crossed and thereby the tile made more economically

POST HOLE DIGGER.—W. G. Stowers, Blacksburg, Va. The object here is to provide a device wherein separable cutting mechanism is provided, capable of detachment for repairs or replacement, and wherein mechanism is provided for connection with the cutting mechanism or bit for loosening the earth as it is cut, or before it is engaged by the bit.

Prime Movers and Their Accessories.

SPARK PLUG.—H. J. Butler and Dr. L. P. Casper, Address the latter, 18th and Ormsby Sts., Louisville, Ky. The invention is for use with explosive engines or the like, and the object is the provision of a plug wherein the electrodes or sparking points are so formed that deposits of carbon and the like cannot accumulate on the points or electrodes, thus preventing the passage of the spark

INTERNAL COMBUSTION ENGINE.—C. P. Hinds, care of Colorado Fuel and Iron Co., Calcite, Colo. The primary object here is to produce an engine which will contain few working parts to wear or get out of order, and which will provide ample room for the water jacket for cooling the same and being only a little larger than the average size two and four-cycle engines for automobiles and similar purposes now in common use

Railways and Their Accessories.

RAILWAY TIE.—A. Kangas, 613 W 3rd St., Ishpeming, Mich This invention relates to the construction and maintenance of railways, and the main object thereof is to provide



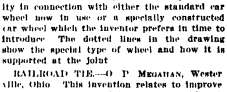
RAILWAY TIE.

a permanent tie for rails of such railways A further object is to form the ties of metal, preferably channeled, and to provide rail clamps in connection therewith which are in uniform position on all the ties

AUTOMATIC TRAIN STOP.—B. D Tripp, 50 Church St., Binghamton, N. Y. This invention has particular reference to means for automatically controlling the operation of railway trains whereby the brakes will be applied in the event of the failure or incapacity of the engineer to observe danger signals or in case the locomotive wheels should leave the rails

AUTOMATIC TRAIN CONTROL SYSTEM.—M. L. Winn, Russellville, Ark This invention relates to systems used for stopping or otherwise affecting moving trains by aid of an apparatus which is itself controllable by movements of trains It is of special application for enabling a train, passing along a track, to actuate movable arms spaced at intervals along the track in such manner as to raise and lower these arms one at a time.

RAIL JOINT.—W. M. Glotfelty, Oildoyle, Pa The primary purpose here is to provide a joint that will bring about a practically continuous rail which will relieve the rolling stock from all shocks, jolts and jars in passing there



IMPROVED RAIL JOINT.

over, and which will operate with equal facility in connection with either the standard car wheel now in use or a specially constructed car wheel which the inventor prefers in time to introduce The dotted lines in the drawing show the special type of wheel and how it is supported at the joint

RAILROAD TIE.—O. P. Meighan, Wesleyville, Ohio. This invention relates to improvements in steel railroad ties, and the object is to provide a steel tie so constructed that while insuring the desired resiliency of the portions to which the rails are secured, will reliably support engines of the heaviest type.

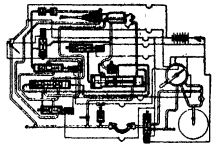
AUTOMATIC TRAIN CONTROL.—C. H Goodmaster, care of Byron Millett, Olympia, Wash. The invention provides a roadway with a continuous series of signals arranged in pairs the signals of each pair being on opposite sides of the railway track and spaced at a distance equal to two blocks, the signals of the next pair being arranged to lap over or break joints with the preceding pair, where a reliable interlocking block signal system is provided.

MINE CAR DOOR LATCH PLATE.—J. R. Fleming, 801 Monroe Ave., Scranton, Pa. Among the principal objects which the present invention has in view are: to protect the wooden frame forming the door opening; to provide reversible latches, and to simplify and cheapen the construction of cars of the character named.

SCOTCH BLOCK FOR STOPPING RUNAWAY RAILWAY OR TRAMWAY VEHICLES.—A. H. Stockhausen, Post Adelaide, and W. G. Brinkworth, Adelaide, S. Australia, Australia. The block consists of a bed and a projection rigidly fastened together or formed of one piece and having upon one side a spring catch engaging a rocker pivoted to the track and connected to a suitable operating lever. The rocker is operated and the block set upon the rail or removed therefrom either by a lever alongside the track, or it may be operated by a lever and rods from a convenient cabin.

STATION PLATFORM.—C. M. Swoppone, 12 Willow Place, Yonkers, N. Y. The invention relates to subway and other station platforms where the track is curved, and deals especially with means for closing the gap or bridging the space between the curved track side of the platform and the body of the cars at the doorway thereof, so that accidents to persons entering or leaving the cars are effectively avoided.

ELECTROPNEUMATIC AIR BRAKE SYSTEM.—J. P. Costelloe, care of O'Flaherty, 6 W. 107th St., New York, N. Y. This invention provides a simple brake system which can be easily and at little cost applied to standard automatic fluid brakes, which is automatic in action and uniform in operation, and which



ELECTROPNEUMATIC AIR BRAKE SYSTEM.

will actuate the brakes simultaneously throughout the train It also provides a brake system which will permit the use of the same as a standard pneumatic system or as an electropneumatic system, and the change from one to the other can be made simultaneously.

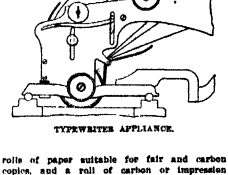
Pertaining to Recreation.

CONVERTIBLE DUMB BELL.—A. J. Latella, 316 Baltic St., Brooklyn, N. Y. This improvement refers to a dumb-bell of the convertible type, that is to say, it can be converted from an elastic or yielding dumb-bell to one resembling a solid dumb bell, the weights of which are adjustable, whereby the article is of universal application

COMBINED CIGAR LIGHTER AND CUTTER.—L. D. Grasshebger, General Delivery, Richmond, Va. An object of the invention is to provide a device by means of which a cigar cutting or clipping mechanism may be operated simultaneously with the lighting mechanism at a single movement. A further object is to provide means for returning the parts to normal position when the device is not in use.

COMPUTING MECHANISM.—J. V. Souder, 370 Prospect St., Meadville, Pa. This improvement is adapted to be used with any desired mechanism, as, for instance, it may be combined with a recording machine in the form of a typewriter and associated with the mechanism thereof, so as to be operated by the usual number of keys provided on that kind of mechanism

TYPEWRITER APPLIANCE.—E. E. Kasun, W V Humble, and E. G Remmers. Address the last, Majestic Bldg., Oklahoma, Okla. The appliance permits the use of continuous strips to be used in the typewriter, thereby economizing in time, by eliminating removing and replacing separate sheets of paper. To this end mechanism is provided for supporting



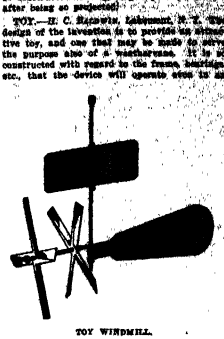
TYPEWRITER APPLIANCE.

rolls of paper suitable for fair and carbon copies, and a roll of carbon or impression paper, and for conducting the said strips in superposed relation beneath the platen roll of the typewriter, and for severing the strips of paper transversely into sheets of suitable size, after they have been written upon.

GAME APPARATUS.—Johanna L. Ryan, care of C. A. Tourow, 309 S. Clinton Ave., Rochester, N. Y. This invention has for its object to provide a game apparatus having a board with a side wall thereabout, there being at one side of the board an inclosure with two openings into which a player may roll a number of marbles. Means are provided to act as guides and obstructions in rolling the marbles into the openings in the inclosure.

TOY AEROPLANE.—F. Bassi, College, Conn., N. J. Among the objects of the invention is to provide a toy machine to be operated into the air against the resistance of the atmosphere and which will be guided in its course so constructed as to glide quietly to the ground after being so projected.

TOY.—H. C. Hardwick, Lakemont, N. Y. The design of the invention is to provide an attractive toy, and one that may be made to serve the purpose also of a weathervane. It is so constructed with regard to the frame, bearings, etc., that the device will operate even in an



TOY WINDMILL.

exposed place for a long period without attention or repairs. A single piece of wire is formed to constitute the frame having a shaft or axis about which the wind wheels revolve, a socket or sleeve for a suspension rod, and means for the connection of the weathervane.

TOY MOTOR BOAT.—H. Bergh, 109 W. 76th St., Manhattan, N. Y., N. Y. The invention provides a prime mover, the motive power whereof may be readily and quickly renewed; provides a toy the parts whereof are easily and

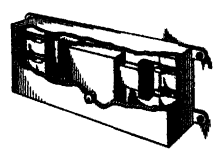


TOY MOTOR BOAT.

readily renewable; provides a toy the parts whereof may be separated for transportation and quickly and readily assembled; and provides a toy with a simple and efficient rudder.

Pertaining to Vehicles.

SAFETY ELECTRIC CIRCUIT SYSTEM.—W Bolton, Maple Ave., Hastings-upon-Hudson, N. Y. The invention provides a key controlled, movable lock bolt having on each end a bridge adapted to contact two adjacent springs, each pair of springs being in circuit with a single battery and being associated with any usual or well known ignition controlling switch mounted



SAFETY ELECTRIC CIRCUIT SYSTEM.

upon the dash board, or the like, of the vehicle, whereby, when the vehicle is left in locked condition with the ignition switch open, a stranger attempting to start it will first turn the switch into operating position, causing the sounding of an audible alarm, and without being able to start the engine because of the break in the ignition circuit.

NOTE.—Copies of any of these patents will be furnished by the Scientific American for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Patents for Inventions

The Patent Office has announced that patents for inventions and trade-marks, issued while Russia was in power, were lawfully granted under a law that considerably antedated that regime, and that they are protected by international convention, the Mexican Patent Office has rescinded its previous order voiding such patents and trade-marks. It will be necessary, however, for all patentees who obtained their grants during the Russian regime to procure new title deeds if they wish to maintain their rights. These deeds will be issued on application, and without the payment of the small fees that were required under the previous ruling.

A Charles P. Steinmetz Vapor-Rectifier System.—Patent for the invention of Charles P. Steinmetz, No. 1,097,062, provides improved means for exciting mercury rectifiers utilized in converting alternating current into uni-directional current in vapor-rectifier systems.

New Textile Effects in Printing.—William Berry of Nunhead, England, has patented, No. 1,097,075, a method of printing by which to secure more realistic textile or other effects for use in advertising leaflets or posters, picture postcards, etc.

An Automatic Train-Stop.—In patent No. 1,097,457 Paul Nerce Mathis of New York city provides a train-stop by which to prevent cars equipped with air brakes from passing a danger signal except under direct orders and at slow speed.

An Eye and Nose Guard.—Pablo Horacio Cordovis of Havana, Cuba, has secured patent No. 1,097,538 for a protector for the eyes and nostrils against dust and other flying particles.

Wire Nails for Railway Ties.—To protect wooden railway ties against crushing strains patent No. 1,097,564 has been issued to Andrew Stark of Chicago, in which a multiplicity of wire nails are set in the material of the tie immediately under the rail.

A Novel Amusement Apparatus.—George C. Hale of Kansas City, Mo., in patent No. 1,097,627 shows an amusement apparatus for exhibiting at low altitudes pictures taken from lofty points, so that persons who because of weak or nervous condition cannot go to high altitudes, can enjoy the scenery visible from such points.

An Improved Submersible Boat.—Patent No. 1,108,192, issued upon the invention of Gustav M. Lagergren of New London, Conn., is for a submersible boat in which is provided an improved operating mechanism for the hydroplanes or steering blades so that they may be conveniently brought into any desired steering position and so easily caused to assume an inoperative position against the sides of the vessel.

Three John Scott Medals Awarded by the City of Philadelphia.—The City of Philadelphia, acting on the recommendation of The Franklin Institute, has made awards of the John Scott Legacy Medal and Premium to Adolph Spielman, of Philadelphia, for his Cloth Cutting Machine; to Jesse W. Reno, of New York, for his Escalator, and to Charles S. Batdorf, of New York, for his Coin Counting and Wrapping Machine. Mr. Spielman's invention is an electrically-driven portable machine which cuts up to 150 thicknesses of material at one time to any desired pattern. The cutting is performed by an endless chain, the links of which are made in the form of knives, and which travels at a rapid rate. The escalator of Mr. Reno is for carrying persons from one level to another in comfort and safety. It consists of an inclined endless belt made in small sections hinged together. Projections on the landings register with the links and enable the passengers to step on and off the device without timidity. Mr. Batdorf's coin counting and wrapping machine accurately counts and wraps coins of one, five, ten, twenty-five or fifty cent denominations into crimped cartridges containing twenty, twenty-five, forty or fifty coins as desired. The machine handles 350 coins a minute, and reports counterfeits [illegible] to use in several [illegible]

A Typewriter Improvement.—Thaddeus Cahill, of New York city, has secured a patent, No. 1,097,789, for a typewriter designed to prevent the operator from printing letters one on top of the other at the end of the line.

Shielding the Cigar from the Wind.—Edward S. Clifford of New York city, has patented, No. 1,106,495, a wind shield for lighted cigars in the form of a thimble or tube closed at its outer end and so fitted loosely over the lighted end of the cigar as to provide air passages around the body thereof.

Improved Wireless Antenna.—In patent No. 1,106,945 Nicholas J. Jeffries of Atlantic City, N. J., provides an improved form of antenna which is portable, collapsible and extensible, can be employed as either a transmitter or receiver and quickly hung from the limb of a tree or other support.

Economizing Space in Railroad Cars.—In patent No. 1,106,169, John G. F. Thomas of Chiswick, England, economizes space in railway motor coach by sloping the floor downwardly from the middle toward both ends and locating the motors or engine between the central elevated or raised portion of the floor.

Illustrating the Operation of Stock Exchange.—A game device has been patented, No. 1,106,090, by Charles H. Gessner of Bergenfield, N. J., which is designed to illustrate by suitable apparatus the method of operation on the various exchanges of the country, particularly the stock exchange.

Multiplex Record Holder for Sound Reproducer.—Hyman E. Markel of Nashville, Tenn., in patent No. 1,111,716, shows a sound reproducing machine having a novel construction for bringing successively into operative position the cylinders arranged in series.

A New Gillette Razor Patent.—King C. Gillette of Brookline, Mass., has secured patent No. 1,111,721 for a safety razor which includes novel features in the handle devices and in the means for securing the blade and facilitating its application and removal.

Buttoning False Teeth into Place.—Grover C. Otrich and Julius L. Bischof, of Bellville, Ill., have secured a patent, No. 1,101,810, for securing dental plates in position in which snap fasteners are employed, the ball being anchored to the jaw and the socket carried by the dental plate.

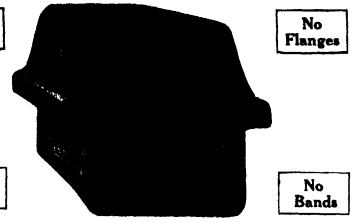
A Phonographic Record Holder.—Fred Evans, of Summit, and Malcolm Campbell, of Englewood, N. J., assignors to Patented Devices Company, New York city, present in a patent, No. 1,101,623, a phonographic record holder, in which disk-shaped partitions are supported between standards.

A Pistol which Illuminates the Target.—The purpose of patent No. 1,095,686, secured by Albert Lee Webb of Sudbrook, Md., is to illuminate the target and to indicate by a fuller or brighter light the sighting point. The broad idea is not new, as readers of the SCIENTIFIC AMERICAN know, but this modification is interesting.

Cumulative Antenna Effects.—Walton Harrison, of Brooklyn, N. Y., in a patent, No. 1,097,974, provides a receiver for wireless communication in a system in which the responsive effect of a number of antennæ and separate wave detectors is rendered cumulative and thereby made more distinct, and also rendered less irregular.

Motion Acts Combined with Moving Pictures.—Jacob Saudek, of New York city, has obtained patent No. 1,099,207, for combining motion acts and moving pictures. After the cessation of the living impersonations the moving picture apparatus instantly reproduces in succession the impersonations previously portrayed upon the film.

A Wireless Telegraph Patent Granted to Lee de Forest.—Lee de Forest, of New York city, in a patent, No. 1,101,533, presents a system of wireless telegraphy in which the horizontal receiving antenna is divided into two parts, each connected with an intermediate detector and corresponding with a substantially horizontal transmitting antenna.



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Remember all that has been done in the attainment of such tire perfection, efficiency, and economy. The work done by the men in the Goodyear Experimental Department in the development of Goodyear Tires costs us $100,000 a year. It is the price we pay for your insurance of tire value.

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It will pay to ask us to tell you of concerns using 1915 Goodyear S-V Truck Tires, and how they have reduced cost per tire-mile. It will interest you to learn how these concerns are saving equipment—the load—the driver's time—how they are keeping trucks in commission day-in-and-day-out by using Goodyear S-V Truck tires—to-day's last word in truck tire efficiency.

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Makers of Goodyear No-Rim-Cut Automobile Tires

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When you consider that the passengers in the tonneau are directly over the wheels it is apparent how important a feature are the springs.

Riding comfort can only be attained by equipping your car with the right springs, not too flexible, not too stiff, yet strong enough for perfect security.

Detroit Springs are *especially designed* for the particular car upon which they are to be used.

Our engineers decide upon the composition of the steel, the number and thickness of the leaves and the exact temperature of the *three heat treatments*. These specifications determine hardness, flexibility and resilience to a certainty, and the finished spring is tested to prove every quality.

Detroit Springs Are Guaranteed for Two Years

An exclusive feature that further adds to their riding comfort is the self-lubricating cups. Near the end of each leaf is a cup filled with a long-lived lubricant that prevents squeaking and reduces friction

Look for Detroit Springs

on your next car. You who sit over the wheels will experience comfort in riding that will repay you

Write for the interesting book—"From the Ore to the Motor Car." You will be amazed to learn what care and accuracy are involved in the making of a perfect spring.

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Legal Notes

Attorney Joseph R. Church Dies.—Joseph R. Church died on June 16th at his residence in Washington city. Mr. Church was a well-known patent attorney having entered the profession in 1865 in association with his brother, Mr. Myron D. Church. Prior to this, he was an official of the Patent Office, resigning the position of examiner of interferences during the incumbency of which he rendered the decision in the celebrated telephone interference case. He, from his earliest practice, held a high place in the profession, and was much esteemed for his ability and sterling qualities.

A Decision on Reduction to Practice.—In Thomas vs. Stewart, Commissioner Ewing has held that where an inventor has sold or parted with the property rights to an invention which has not been reduced to practice by him, and the owner of such property rights has caused the conception to be reduced to practice with reasonable diligence, the right of such owner is secure, whether or not the inventor contributed to the reduction to practice. In the course of his decision, the Commissioner suggests that it frequently happens that inventors of ability are not good in matters of construction, or are so absorbed in their creative work as not to be interested in the detail involved in a reduction to practice.

Limitation Omitted from Some Claims.—It was held in Rollman Manufacturing Company v. Universal Hardware Works that where a limitation expressly stated in some of the claims of the patent is omitted from others it cannot be read into them to avoid a charge of infringement.

Terrorizing a Trade.—It has been held in Atlas Underwear Company v. Cooper Underwear Company, 210 Fed. 347, that an injunction would be granted to restrain the owner of a patent from attempting to enforce his rights by terrorizing the trade or customers of competitors through a succession of threats which he never attempts to carry out. In another case, Clip Bar Manufacturing Company v. Steel Protected Concrete Company, 209 Fed. 874, the court held that notice of infringement given by the owner of a patent to customers of a manufacturer of a similar article, and even threats of suit, if in good faith, are within its rights and not actionable as acts of unfair competition.

Registration Renewals Not Subject to Examination.—The Court of Appeals of the District of Columbia, in the case of Commissioner of Patents v. Standard Oil Company of New York, has held that the renewal of a trademark registration confers no new rights, and that a request for renewal is not subject to examination as in the case of an original application.

The Steinberger-Hewlett Interference.—The United States Circuit Court of Appeals in General Electric Company v. Steinberger has affirmed the decision of the District Court, Eastern District of New York, decreeing that Hewlett was the first inventor and entitled to a patent. Previously in the Patent Office in the interference involving Hewlett's application and Steinberger's, the other party's patent, the Examiner of Interferences had awarded priority to Hewlett, and the Board of Examiners in Chief affirmed his decision. The Commissioner of Patents reversed the decision and awarded priority to Steinberger and the Court of Appeals of the District of Columbia affirmed the Commissioner's decision. Now the United States District Court and the Circuit Court of Appeals have gone back to the decision of the Examiner of Interferences. The Circuit Court, however, pointed out that the suit was in no sense an appeal from the Court of Appeals of the District of Columbia, there being testimony in the record which was not before that tribunal. The case turned upon a sketch sent by Steinberger to a co-worker of Hewlett, the important point being whether the sketch disclosed the subject matter of the invention in interference. The Circuit Court held it did not. It is interesting to note the question of priority of invention as between these two inventors was the subject of six decisions, the first, second, fifth and sixth being in favor of [illegible] and the third and fourth



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Below are a few letters, out of literally hundreds, telling what it has done. Still stronger proof that it is best can be secured *in your own case*, by our open guarantee. Now is an opportune time to repaint; we invite stringent comparison of Rice's Gloss Mill-White with every other interior finish.

A Few of Many Users

General Electric Co.
Pierce Arrow Motor Car Co.
Ford Motor Car Co., Detroit, Mich.
Eastman Kodak Co., Rochester, N.Y.
Gillette Safety Razor Co., Boston, Mass.
Chas. Peabody & Co., Troy, N.Y.
Royal Typewriter Co., Hartford, Conn.
General Fire Extinguisher Co., Providence, R. I.
Waltham Watch Co., Waltham, Mass.
United Shoe Machinery Co., Beverly, Mass.
Seconnet Mills, Fall River, Mass.
Lancaster Mills, Clinton, Mass.
White Mockine, Whitinsville, Mass.
New Nashawena Mill, New Bedford, Mass.
Graniteville Mfg. Co., Graniteville, S. C.
West Point Mfg. Co., West Point, Ga.
Quittacus Mills, New Bedford, Mass.
Berkshire Cotton Mfg. Co., Adams, Mass.
Foster Machine Co., Westfield, Mass.
Ballard Machine Tool Co., Bridgeport, Conn.
Massachusetts Mills in Georgia, Athens, Ga.
The Fell City Mfg. Co., Fell City, Ala.
Indian Head Mills of Alabama, Gadsden, Ala.
Palmetto Mfg. Co., Greenville, S. C.
Waterbury Farrell Foundry and Machine Co., Waterbury, Conn.
Tremont and Suffolk Mills, Lowell, Mass.
Wamsutta Mills, New Bedford, Mass.
Elmwood Check and Mfg. Co., Indianapolis, Ind.
Chadwick-Hoskins Co., Charlotte, N. C.
Rogers-Brown Co., Syracuse, N. Y.
Hudson Mills, Hudson, N. Y.
Hamilton Mfg. Co., Lowell, Mass.
Lowell Machine Co., Boston, Mass.
Arkwright Mills Co., Nr. Spinning, Mass.
Whitin Machine and Metcalf Spinning Co., Whitinsville, Mass.
Textile Mill, Utica, N. Y.
Textile Mills, Co., Talladega, Ala., and Fell City, Ala.
Wm. A. Sloan Mills, Fell City, Ala.
Fitchburg Paper Co., Fitchburg, Mass.
Bridgeport Brass Co., Bridgeport, Conn.

Why it is better than imitations

Rice's is the original Mill-White; all others are imitations and they can imitate only for a short time. For this *is the only Mill-White made without varnish.* For that reason it does not crack and scale like others; it does not flake off with the jar of machinery. It is made by a special process, *discovered and owned exclusively by the makers.* There can positively be no substitute which gives as good service.

Imitation "Mill-Whites" may look as good when *first* put on. But six months' exposure will prove their inferiority. By that time many are so yellow that they might be yellow paints. Repeated tests have shown, *without a single exception*, that Rice's remains white longer than any other.

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Rice's Gloss Mill-White is the original "mill-white." All others are imitations. It is the *only* gloss paint which contains no varnish. For that reason, we *guarantee* that if Rice's does not remain white longer than any other gloss paint—applied at the same time and under the same conditions—we will give, free, enough Rice's to repaint the job with one coat. We also guarantee that, properly applied, Rice's will not flake or scale. You cannot lose under this guarantee.

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Has been on for three years and is still in excellent condition.—Batrd-North Co., Providence, R. I

We are indeed astonished to note the vast amount of daylight created by this paint —especially where we were formerly forced to use electric lights all day. Now find it entirely unnecessary. Agreeably surprised to observe how easy it is to keep clean.—Kneeair Hosiery Co., Philadelphia, Pa

The most practical interior finish we have ever used on walls and ceilings. We imagine we will show an increase of between 20 and 25% in light.—R. J. Reynolds Tobacco Co. (Makers of Prince Albert)

Find it very satisfactory indeed.—Gillette Safety Razor Co.

The best thing we know of.—H. Doherty Silk Co., Paterson, N. J

Tested it in competition with several other makes. The architect and owners respectively, Mr. Pell and Canadian Yale & Towne Co agree that yours is the best in appearance.—F. Telford, Niagara Falls, Ont.

Still pleased with the finish which was applied three years ago. It is in as fine and permanent condition as when applied.—General Fire Extinguisher Co., Providence, R. I

Out of six comparative tests, Rice's Mill White lasts.—Killingly Mfg. Co., Killingly, Conn.

We gave your paint a severe test in connection with several brands and your paint stood the test the best, and gave complete satisfaction.—The American Pin Co., Waterbury, Conn

Have used it for several years. It increases the light very materially and creates a very clean, wholesome effect.—Royal Typewriter Co., Inc., Hartford, Conn

Altogether the best thing of its kind we have ever seen.—The Belle Meade Sweetmakers, Trenton, N. J

The difference in appearance is almost beyond imagination. The same gloss and whiteness remain to this day.—Greylock Mills, North Pownal, Vt

123 Pleasure and Commercial Vehicle Manufacturers list the certainty of Continental Motors as first in the specifications.

For out of the eight good qualities for which any Truck or Car is selected, six depend on the motor alone.

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✓ Power ✓ Flexibility
✓ Speed ✓ Simplicity
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In these six particulars, Continental reputation for excellence is years long, world-wide, and unassailably supreme.

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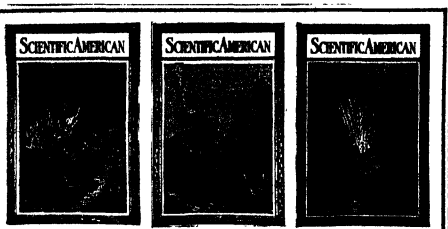
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For this reason 123 Manufacturers make sure of sales and satisfaction by building into their product the Certainty of Continental Motors. It is irrefutable that this standard Motor, representing one-fourth of the total manufacturing cost of a Car or Truck, guarantees *three-fourths of its potentiality for service.*

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The Military Resources of Turkey

(Concluded from page 464.)

and has captured or sunk [illegible] Russian merchant fleet. The most important engagement was one between the "Goeben" and a squadron of Russian battleships and cruisers, in which each claimed the advantage. The Turks state that a Russian battleship was severely damaged, and with the other Russian war vessels fled to Sebastopol. The Russians claim that a division of the Black Sea fleet, returning from a cruise to Sebastopol, engaged the "Goeben" and the "Breslau." They state that the 12-inch guns of the flagship "Admiral Edstafry" landed with damaging effect upon the "Goeben" which, utilizing her great speed, withdrew and joined the "Breslau." This vessel, being an unarmored ship, took no part in the fight.

Field Gun and Aerial Projectiles

(Concluded from page 468.)

producing material at *F* is intended to increase the visibility of burst. As the two explosions are separated by a considerable distance, the chance of fragments hitting is increased, and the flame from *B* would explode a balloon. The efficiency of the projectile for land warfare has not been appreciably decreased by these modifications.

Bombs or "drop projectiles" adapted to be dropped from aircraft are of relatively simple construction, as they do not have to withstand the accelerating force of powder gas. A typical projectile is shown in Fig. 7. The firing pin *A* is locked by the screw *B* to make explosion impossible during transportation or on landing. A safety wire *F*, which is removed before dropping, is an additional safeguard. When the bomb is dropped the resistance of the air causes vane *C* to rotate, which unscrews the screw *B* and releases the firing pin *A*. A stop pin *G* keeps the firing pin from rotating, but does not interfere with its forward motion. On impact the firing pin *A* strikes the detonator *D* and explodes the high explosive charge *E*.

It is rather early to predict the ultimate use of such bombs, but in so far as field armies in the present war are concerned, it is safe to say that due to the limited weight that the largest airship can carry their effects will not be any more terrifying and will be far less important than those of the enormous number of gun projectiles, which are thrown with greater accuracy and usually from guns that cannot be seen by those attacked.

Among recent United States patents may be found several assigned to Fried. Krupp Aktiengesellschaft, on searchlight projectiles. These projectiles are arranged to burst in the air, throwing out a number of "candles" or luminous bodies that light up the surrounding country for a considerable area and reveal the movements of the enemy. Each candle is provided with a parachute that unfolds as soon as it has been discharged from the cell, so that the candle will drop very slowly and will burn for a long time before striking the earth. The arrangement of such a projectile is shown in Fig. 8. It is similar to a base chamber shrapnel, and is provided with the usual time fuse *A* and bursting charge *B*. The interior of the shell is provided with a number of candles each fitted in a casing *C*. The fuse is set to burst the projectile when it is on the descending part of the trajectory, and as soon as the candles are disengaged from the shell, the caps *D* are thrown off by a spring *A*, which releases the parachute *F* (see Fig. 9). At the same time the candle is ignited by means of the match *G*. After their ejection the candles fall slowly to the ground, while the light material *H* burns brightly.

The accompanying drawing illustrates the effect of one of these shells in disclosing the movements of the enemy without betraying the position of the gun from which it was fired.

A Hiram Maxim Silencer for Gas Engines.—Hiram Percy Maxim of Hartford, Conn., has secured patent No. 1,111,895 for a silencer for gas engines including a novel construction of deflecting means [illegible] this motor body.



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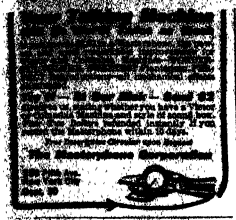
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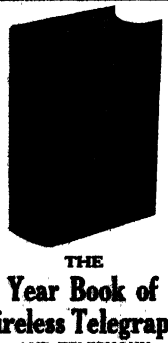
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FINALLY we were all ready. The machine was completely assembled and had made a trial flight. We were both in, ready to start. The evening before we had received our orders to make a round trip of 230 miles over the enemy's country. Would we be able to make it with the fuel tanks we had? We had figured on a 186-mile flight as the longest How we were envied—we who were to make the first reconnaissance!

At 3 o'clock we started in scorching heat. If only we do not have a motor breakdown! Throughout 200 miles we shall be over the enemy's country The inhabitants are bestial. If we are forced to descend after an hour's flight over their soil, it will take us three days to walk back. But the Mercedes is running fine and steady as a clock. As we cross the border we give three "Hurrahs!" Two beings in a world of their own! We are 2,300 feet high as we enter the enemy's country. Our course is to Verdun and beyond. A cautious man takes no chances, so we rise to 5,000 feet, as we do not know how high we must fly in order to be out of range. The roads leading to the Maas were empty and the villages deserted. Where were the enemy's troops? We had expected they would defend a part of the river. After a 1½-hour flight its waters shimmered below us in the sunlight. The scene was one of peace. So perfectly did the motor run that our confidence in it increased every minute. We no longer watched the revolution indicator nor listened for skipping of explosions. Just as I looked back to enjoy the wonderful scene my companion, with an exclamation of delight, pointed out the first French troops, who were in a few scattered camps east of Verdun, while northwest of that place they became thicker Soon we saw them moving in different places. West of Verdun we saw a broad, thin streak of smoke. We had been shot at. We laughed sarcastically and kept right on our way. Twenty miles west of Verdun we turned in a wide curve As we were nearing the mass on the return trip we saw a French biplane start up and climb rapidly In a trice the Frenchman climbed to within 650 feet of us. Had I tried to make a detour he would have cut across He was climbing very fast and we watched him with great anxiety. Soon we were almost upon him, climbing ourselves to keep above him. Next he was just below our left wing. Then he was behind us We laughed joyfully, for we had known all the time that we were faster than he Our machine was also a better climber, for we were 1,000 feet above the French one as we passed.

And now, Home! We had 62 miles to make and but 40 liters of fuel to fly the distance. Our motor consumed 35 liters an hour, but we hoped we would make it somehow. We reduced the revolutions about forty in the endeavor to save a little fuel. My companion read the speed indicator and found we were making over 71 miles an hour, so we figured we would just be able to reach home.

Finally we were over German troops again. We breathed a sigh of relief. If the motor stopped now it mattered but little, as we would land among friends. But our faithful Mercedes brought us safely back to our starting point. We had made a four-hour flight, yet we still had 8 liters of gasoline left in the tank. Our comrades received us joyfully, glad that we had returned safely with information about the enemy. One of my mechanics, after looking over the surfaces, cried "Three hits!" and pointed to three bullet holes through them. We had flown too low, after all. Now we know, from bitter experience, if we fly at less than 1,000 meters (3,280 feet) we will be brought down almost every time. Only after we reach a height of 1,700 meters (5,576 feet) are we fairly safe from infantry fire.

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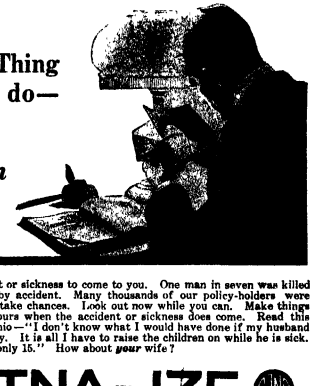


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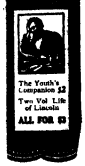
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while when over the enemy's country under conditions of war time fairly spins by, setting one's nerves on edge and riveting one's attention on the work in hand. "Where can you land if the motor stops?" This one thought that is uppermost in your mind in times of peace does not occur to you now. You fly straight ahead without giving a thought to where you will land or what will happen if the motor fails.

This was the first flight with my fine A. E. G. machine above hostile soil. Valuable information was obtained and the authorities were greatly impressed. Five weeks have since passed and the machine has flown some 2,000 miles. The three bullet holes have increased to nine. All were without serious damage. The tenth struck the propeller at a height of 4,000 feet. I was flying at a height of 6,500 feet in clouds. As I emerged I was over hostile troops, who opened fire. Suddenly the machine was struck a hard blow. A bullet had hit the running gear and rebounded against the propeller. A splinter 6 inches long by ¾ inch wide was broken off, but the propeller still worked well enough for me to return to my starting point.

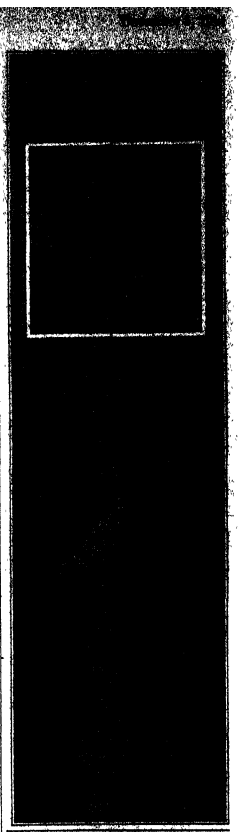
I always supposed that during a flight of several hours' duration I would come upon numberless French machines. You only find them, however, over their own troops. They are no good for going out long distances and bringing back information, but for fighting they are first rate. The French aviators rise from behind the battlefield 100 meters in a jiffy without running any risk of being shot down, take a glance or two at the disposition of our troops, and as quickly descend again and alight. It looks as though they use their large heavy machines for defense alone. "Peasant-scarers" is what we have dubbed a giant, steel-colored Farman biplane which carries a machine gun and has chased and hit a number of our fliers, but without doing serious damage.

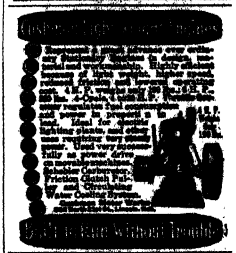
Many thousand kilometers have been flown by our aviators, and a nice job it is for a man with body and soul.

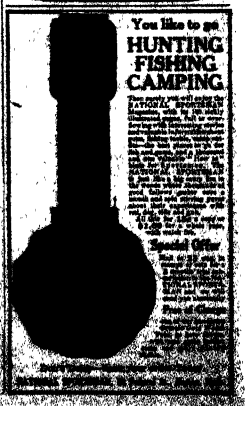
Concrete Freezing

THE use of chloride of calcium is recommended by some authorities to prevent the freezing of concrete. It is a well-known fact that solutions of different salts are more difficult to freeze than pure water, for instance a 20 per cent common salt solution only freezes at 14 deg. C. below the freezing point of water, and a chloride of calcium solution freezes at a still lower point, or 18 deg. C. below. This phenomenon can be made use of in connection with concrete working, and such solutions are used when preparing the material so as to lower the freezing point. In this way it is possible to carry out work with concrete even during very great cold, which would not be practicable by the ordinary process. It is better to use chloride of calcium instead of common salt for such work, as the former salt increases the waterproof quality of the concrete and is much preferable for this reason. Experiments have been made in order to determine the best amount of chloride of calcium to use in the mixing, and after a number of trials made by forming bricket proof pieces and then testing these, it was clearly shown that the best resistance of the specimens was given by using 2 per cent chloride of calcium. Since there is commonly used from 10 to 15 per cent of water in mixing the concrete, the addition of 2 per cent chloride of calcium means that a 15 or 20 per cent solution is employed, and this lowers the freezing point of such water to 10 or 18 deg. C. below freezing point of water respectively. Adding more than 2 per cent of the salt is found to increase the speed of setting, but it is remarked that concretes are less resistant as the setting is quicker, so that it is not well to go higher than the foregoing figure.

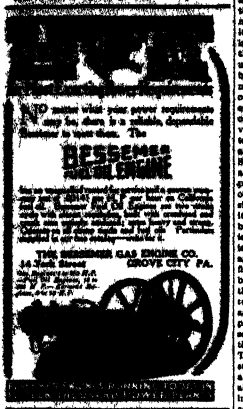
Sir Hiram Maxim Invents a Vacuum Cleaner.—Sir Hiram Stevens Maxim, of West Norwood, England, has secured a patent, No. 1,101,583, for a vacuum cleaning apparatus, in which he seeks to subject the filter of the cleaner continually to the pulsating effect of the suction mount, meanwhile relieving the dust settling character of these pulsations.

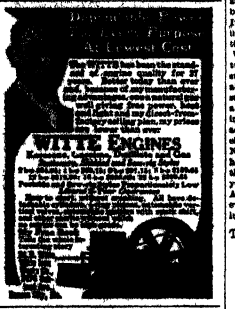


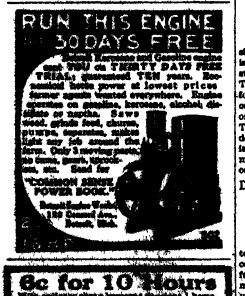
















NEW BOOKS, ETC.

PICK, SHOVEL AND PLUCK. Further Experiences With the Men Who Do Things. By A. Russell Bond. New York: Munn & Co., 1914. 12mo., 5¾ x 8¼. 255 pp.; 110 illustrations including 58 page-plates and colored frontispiece. Price, $1.50; postpaid $1.65.

The complexity of the details of engineering are apt to lead the layman into accepting everything connected with the profession as a baffling mystery to all who are not actively engaged in its intricacies. While the stupendous engineering accomplishments of the age awaken within the everyday man an appreciation of the fact that unerring technical skill of the highest order has been brought to a marvelous state of development this same person has not, perhaps, a conception of what might be termed the romance of engineering, the play of that ingenuity which is called forth to meet unexpected problems, the very hazard often experienced in great undertakings in fact the spectacular battles of brain and brawn with the inanimate world. In "Pick, Shovel and Pluck" Mr. A. Russell Bond, the author has achieved the success of lucidly explaining the work of engineering and the tasks of the engineer in language at once clear, direct, simple and forceful and in such a manner that it holds compelling interest whether the reader be versed in the technicalities of the subject or is ignorant of them. "Pick, Shovel and Pluck" is not below the keen appreciation of the adult, and yet any schoolboy will understand it and find delight in its pages, for the subject treated by Mr Bond is in the form of a narrative. As the author says in his preface: "For the adventures it was not necessary to draw upon the imagination Actual engineering work furnishes plenty of novel experiences, some of which seemed so extraordinary as to be almost incredible Take the adventure in the last chapter, for instance Ty have a huge slab of stone drop on a ledge in such delicate poise that it could be rocked like a monster seesaw by the weight of a boy seems almost beyond belief Yet at a different time, in a different place with a different hero, this actually took place The story is vouched for by the head of a reliable house-wrecking company. In fact every story in this book, no matter how unreal it may seem is based on fact. As the subtitle indicates, the present book is a sequel to 'With the Men Who Do Things,' which told of two boys who spent a summer in New York, studying the big engineering undertakings in and about the city The present volume takes the same boys away from New York and gives them a wider variety of engineering experiences, reaching from the Panama Canal to the Keokuk dam across the Mississippi, and finally, in the last eight chapters of the book, bringing them back to New York. As in the previous book the calendar has been ignored, and engineering undertakings that date back many years are staged in the same year with those that have hardly yet begun. As the primary object of this book is to instruct, every precaution has been taken to secure absolute accuracy of all the engineering data."

THE NAVAL CONSTRUCTOR. A Vade Mecum of Ship Design for Students, Naval Architects Shipbuilders and Owners, Marine Superintendents, Engineers and Draughtsmen By George Simpson, Member of the Institution of Naval Architects Associate Member American Society of Naval Engineers. New York: D VanNostrand Company, 1914. 12mo.; 819 pp illustrated. Price, $5 net.

This handbook has been favorably received since its first appearance in 1904, and now reissues in a revised and enlarged form that must still further commend it to its readers. The earlier editions were especially noteworthy for their unification of details, the present edition continues that feature and includes new material of which the paper on weights is a sample. The seven sections which comprise the work are devoted to ship calculations, strength of materials fittings and details, rigging and ropes, equipment miscellaneous and tables It is a very compact volume of authoritative information.

DAVISON'S TEXTILE "BLUE BOOK." United States and Canada. 1914-1915. New York Davison Publishing Company. Price, office edition, $4; pocket edition, $3

Each year we have occasion to call attention to the merit of this directory. It contains the cotton, woolen silk jute, flax and linen manufactures the dyers and bleachers, the matters manufacturers commission merchants, converters and brokers and yarn dealers; the dealers in cotton wool hair waste, and rags, and the merchants in raw thrown and spun silk. It constitutes a classified list of the cotton and woolen mills and includes a directory of mill supplies Its uses and its value are evident from the mere mention of its scope A number of maps add to the efficient service the work offers

CYCLOPEDIA OF AMERICAN GOVERNMENT. Edited by Andrew C. McLaughlin, A. M, LL B LL D., and Albert Bushnell Hart Ph.D., Litt.D., LL.D. Three volumes New York: D. Appleton & Co 1914. Price, $22.50 net.,

The Cyclopedia of American Government is a well-planned and dignified work that fills a popular need It is neither so large as to be unwieldy, nor so condensed as to ignore any important phase of a subject It hits the happy mean between the pedantic and the cheaply popular, and generally succeeds in conveying a sharp and accurate impression of our institutions, laws, and procedures. It is not easy to find a subject which could gracefully come within its scope that is not touched upon by its broad political, historical, industrial, educational, or legal. All the many



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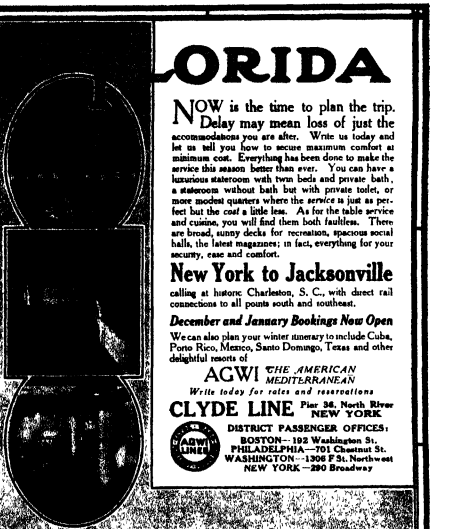
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BULGARIA AND HER PEOPLE. With an Account of the Balkan Wars, Macedonia, and the Macedonian Bulgars. By Will S. Monroe. Boston: The Page Company, 1914. 8vo.; 410 pp.; illustrated. Price, $3 net.

This is another of Prof. Monroe's sympathetic studies of out-of-the-way places and peoples. It is the first book of the kind in English to deal with the new Bulgaria, a country that has made most wonderful recent progress in most of the arts of peace. The author has—so he puts it—"stressed the human side of the subject." These people have an art and literature of surprising merit and virility. The former is well represented by Mirkvicka, the value of whose work is indicated even in the photographic reproductions of Prof. Monroe's volume

ARITHMETIC. Book I. Fundamental Processes. Book II. Practical Applications. By John H. Walsh, Assistant Superintendent of Schools of the City of New York, and Guy Suzzallo, Teachers' College, Columbia University. Boston: D. C. Heath & Co., 1914. Book I, 35 cents. Book II, 65 cents.

The most urgent demand now made regarding instruction in Arithmetic is that fundamental processes shall be emphasized in the lower grades in order that efficiency may result, (2) that the social and economic applications of arithmetic shall be taught in the upper grades, so that grammar school children will have an insight into the typical practices of modern life These books meet both requirements to an exceptional degree. The series is so arranged that a pupil may acquire an easy and accurate command of the processes by the end of the sixth year. The seventh and eighth school years are thus left free for the study of practical applications. No books heretofore offered to schools contain so varied and extended a series of applications of arithmetic suitable to the conditions of modern life such as the rank and file of pupils are likely to meet.

COLLEGE PHYSIOGRAPHY. By Ralph Stockton Tarr, Late Professor of Dynamic Geology and Physical Geography in Cornell University. Published under the editorial direction of Lawrence Martin, Associate Professor of Physiography and Geography in the University of Wisconsin. New York: The Macmillan Company, 1914. 8vo.; 837 pp.; illustrated. Price, $3.50 net.

"College Physiography" meets the requirements of college and normal schools, furnishes a supplementary reader to students of more elementary texts, and is also adapted for general reading It presents the geographical features of our world, cites processes and topographic forms treats of the physical geography of the ocean, and explains atmospheric effects The interest is sustained by connecting all these aspects with their bearings upon human life. Certain omissions are suggested where an abridgment is desirable The ten colored maps, an important feature, have been carefully made. All the subjects of study are generously illustrated by photographs and diagrams of a high order of merit. The reputation of the late Prof Tarr is fully upheld by this volume, which was left uncompleted by his death. To Prof. Martin must go the credit of the last seven chapters and the casting of the entire work into efficient textbook form

PITMAN'S MANUAL OF SPANISH COMMERCIAL CORRESPONDENCE. By G. R. Macdonald. New York: Isaac Pitman & Sons. 12mo.; 328 pp.

The Manual offers a large collection of letter forms both in Spanish and English, with explanatory foot notes There are also various market reviews and financial reports. An English-Spanish vocabulary gives more than 3,000 terms relating to numerals, colors, textiles, countries, and technical and mechanical terms, and is supplemented by a brief Spanish-English vocabulary. The wording in the correspondence forms in English is occasionally awkward or redundant, but this does not seriously impair the value of the work to the exporter. Although there is a table of contents, an index, if only inclusive of the letter forms, would have facilitated reference, since many of the overlapping of subjects is unavoidable. In view of our present relations with Spanish-speaking peoples, and of our enlarging prospects in this direction, the manual should prove distinctly helpful to exporters and their correspondents.

THE AMERICAN BOY'S WORKSHOP. Each Subject by an Expert. Entirely Rewritten and Edited by Clarence B. Coleland of "The American Boy." Philadelphia: David McKay. 8vo.; 339 pp.; illustrated. Price, $1.25 net.

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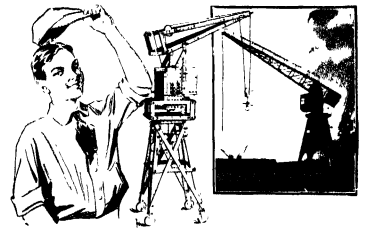
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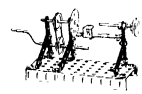
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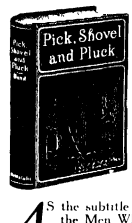
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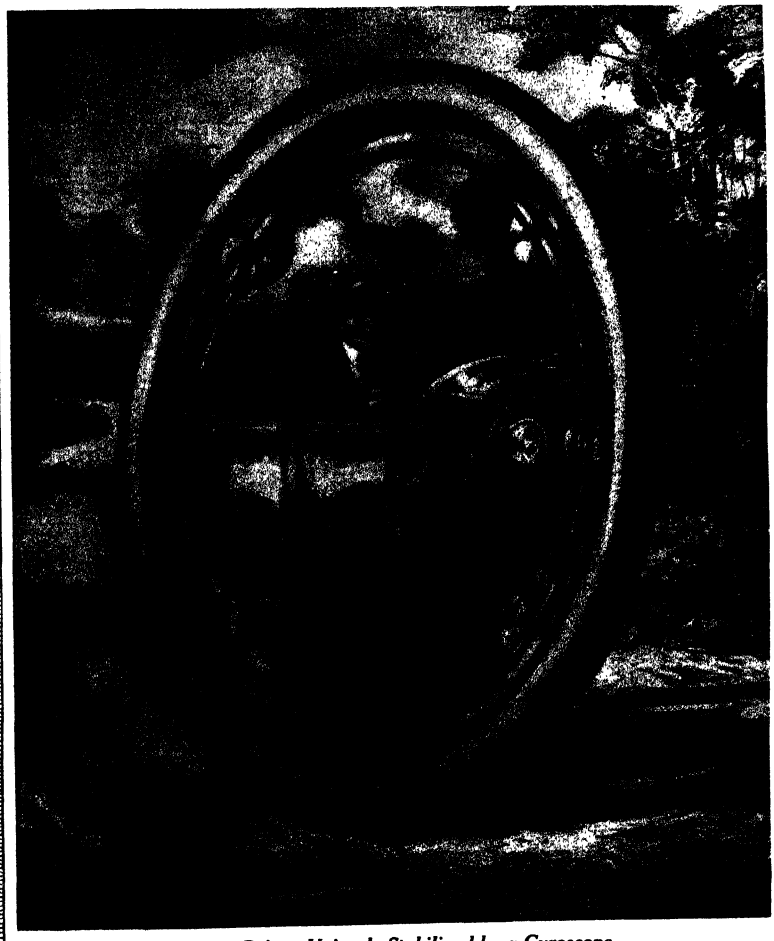
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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic* the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement

The National Security Commission

IF there is something radically wrong with our national defense as represented by our naval and military forces, Congress should know it and pass the necessary legislation to set matters right.

Surely this is a self-evident proposition. Self-evident, also, is the proposition that, if we are to have an army and navy, they should be adequate to their duties. We take it that, in the event of foreign aggression, the temper of the people of this country is such that they would play the part of an heroically resisting Belgium rather than that of a tamely submissive Luxemberg.

Although we are the wealthiest nation in the world, with a population of approximately 100,000,000, we are a people pre-eminently peaceful, indeed, we are recognized to-day as the leading national exponent of the principle of universal arbitration. And yet, if what we conceive to be our proper and lawful national policies were assailed by a country which believed that war was the only possible arbiter of international differences, who among us doubts that this country would resist with all the moral and material resources at its command.

Admitting, then, that this country must possess an army and a navy, and that if these military forces are to be of any value whatsoever, they must be fully adequate to their duties, the question presents itself, Are the naval and military forces in this country in sufficient strength, numbers, and preparedness to meet any possible emergency which may arise?

It is with a view to having this question investigated that Representative Gardner has introduced a joint resolution providing for a National Security Commission, the object of which is to make full investigation, by sub-committee or otherwise, into the question of the preparedness of the United States for war, defensive or offensive.

We have reason to believe that his resolution is entirely free from any political significance, in fact, it goes without saying that a subject of this prime importance, which affects or may affect the very life and death of the nation, should be considered from a purely patriotic point of view, and that every member of Congress, be he Democrat or Republican, should approach the consideration of this matter with a mind absolutely free from political bias, and with a sole desire to do the wisest thing for the good of his country.

To those citizens of the United States and to those members of its Congress who take an intelligent interest in the question of our national defenses, this investigation will be largely a work of supererogation, that is to say, the investigation will merely lay emphasis upon certain most serious defects in our national defense with which they have long been familiar. What proportion of the people of this country and its legislators are well informed as to the situation it is impossible to say, but we believe that the proportion is large. Nevertheless, there are millions of people to whom the truth has not yet been brought home that the unpreparedness of our army, and to a less extent of our navy, is such that, if war burst upon us overnight as it has done upon the nations of Europe, a disaster of the first magnitude must inevitably follow.

It would take a volume to describe the details of the situation. Only a few salient facts can be given here. As regards our army, we have no more than 85,000 effectives; it is short of artillery; and it is so short of ammunition that the whole of its supply would be fired away in a single day's engagement. We have an elaborate system of coast defenses, but only a fraction of the artillerymen necessary to man them. Back of the regular soldiers we have only 120,000 militiamen, and back of these we have absolutely no reserves. We have no heavy mobile siege guns, such as are doing effective work in the European war, and no military motor tractors to render our artillery thoroughly mobile. We have made merely a beginning in developing that aeroplane equipment which is necessary to render field-gun fire accurate against troops in the field.

Although the *materiel* and *personnel* of our navy are both excellent, the navy as a whole is poorly balanced. No type of vessel in the present war has done such distinguished service as the fast, well-armed scout with which the opposing fleets are both well provided. The work of such vessels as the "Arethusa" and "Undaunted" on the British side, and the fast German vessels of the "Emden" and "Karlsruhe" type, needs no recapitulation here. We have but three of these useful vessels when we should have at least thirty. The torpedo and the mine have again, in this war, established their deadly efficiency. We are so short of torpedoes that a single naval engagement of magnitude, involving the employment of all of our destroyers and submarines and the free use of the torpedo, would find our torpedo fleet without torpedo ammunition for the rest of the war. Does Congress doubt this? Then we beg to inform it, using practically the words of one of its naval experts connected with the Ordnance Department, that *it takes about one year to build a torpedo* and that the cost of each is about $5,000; that we shall need to secure within the next ten years from all available sources at least 10,000 torpedoes, and that these would cost in the neighborhood of $50,000,000; that the necessary number could be obtained if the Bureau of Ordnance were authorized to provide for securing the needed supply before the end of the fiscal year 1924, an annual appropriation being made for that purpose of $5,000,000. But Congress has seen fit to pay no heed, or practically no heed, to this statement. We are even shorter in our supply of mines than of torpedoes. The navy is short 18,000 men; and we have no adequate reserve (an adequate reserve should include about 50,000 men) from which to man our reserve ships and auxiliaries in the event of war.

The above are a few of the facts which would be brought out by the National Security Commission. They are sufficient to show the necessity for placing before the nation at large, in the clearest and most emphatic manner possible, the true conditions in our army and navy. The enlargement and improvements demanded are merely such as would be sufficient to put this country in a state of effective defense. Only when this condition of preparedness has been reached will the menace of war be permanently removed from the western hemisphere.

Admiral Mahan

IN the death on December 1st of Rear-Admiral Alfred Thayer Mahan, U.S.N., retired, America loses its most able naval strategist and the world its greatest authority on the subject of sea power. We doubt if any one man has impressed upon naval affairs a formative influence, so deep and widespread as that exerted by the late Admiral in that wonderful series of naval works which bears his name.

Admiral Mahan had recently gone to Washington to take up his work as a research associate in the Department of Historical Research in the Carnegie Institution. He was pursuing a special line of historical inquiry, with the object in view of writing a history of American expansion and its bearing on the subject of sea power. Admiral Mahan had contemplated this task for several years and it was designed to be a monumental work. He had pursued his labors for just about one month, when, after a sudden seizure, he died of heart failure, brought on to some extent, it is believed, by the strain of the European war.

Admiral Mahan was born at West Point, N. Y., September 27th, 1840. He was the son of D. H. Mahan, a well-known professor of engineering at the United States Military Academy. After forty years of service in the navy Mahan, on November 17th, 1896, was retired at his own request, in order that he might be able to devote himself entirely to his writings on naval subjects. Only once, about eighteen months after his retirement, was he called to active duty, when in May, 1898, at the outbreak of the Spanish-American war, he was appointed a member of the Naval War Board or Strategy Board, which was formed for the control of naval operations during that conflict.

The international fame of Mahan was acquired almost overnight as the result of his publication of that famous work, "The Influence of Sea Power Upon History." Before the book was written the Admiral was but little known outside of naval and military circles. In the navy he was recognized as a competent officer and a notable lecturer at the Naval War College. Upon his lectures the works which later made him famous were based; but it is a question whether even at the War College it was realized how great were the analytical qualities and the depth of insight and keen sense of proportion which subsequently, upon the publication of his work, raised him at a bound to the position, universally acknowledged, of the world's greatest authority on the subject of sea power.

"The Influence of Sea Power" was published in Boston and its value was immediately recognized by naval reviewers, first in England and then in Germany. It has been claimed that his book was one of the most powerful influences in bringing about the birth of the modern German navy. It was immediately translated into German and Emperor William saw to it that a copy was placed in the library of every German warship. Two years later he published his "Influence of Sea Power on the French Revolution and Empire," and in 1897 appeared his "Life of Nelson" and also "The Interest of America in Sea Power, Past and Future."

In a tribute to Admiral Mahan issued by the Navy Department, it is stated that in England the leading naval men of the day confessed that it had remained for Admiral Mahan to elucidate the work of the British navy in a way that they themselves had never understood or even dreamed of.

In person the Admiral was unusually tall, 6 feet 2 inches, with clean-cut features and a decidedly attractive personality. He had the reserved manner of the scholar. Although Mahan was an ardent advocate of the possession of powerful military forces and especially *of a navy adequate to maintain the command of* the sea on our own coasts, he was by no means what is called a militarist; indeed, like all military men of the highest stamp, he was an ardent advocate of peace. Outside of his books, Mahan did a considerable amount of literary work for the magazines, and he was always ready to respond to a request for illuminating articles on the current naval developments of the day. Several of these articles have appeared from time to time in the columns of this journal.

A Problem in War Names

"IT'S an ill wind" . . . The war has, for one thing, stimulated interest in geography, and provided the average stay-at-home citizen with a cosmopolitan outlook that will not do him any harm.

We have on other occasions called attention to the fact that Americans are sadly handicapped in their efforts to follow events abroad by the wretched maps of foreign countries found in nearly all American atlases, and we need not, therefore, dwell upon this subject at present, beyond pointing out that the atlases in question are especially unequal to the task of illuminating the war news from the colonial possessions of England and Germany, where so much desultory fighting has occurred. There is, however, one respect in which American cartographers are hardly more at sea than their colleagues abroad, and that is the spelling of geographic names transliterated from the non-Roman alphabets. For example:

The Japanese and British forces recently captured an important German possession in China. What is its name? Let us consult acknowledged *authorities* of English speech, and we shall find: *Kiao-chau*, Century Atlas; Royal Atlas *Kiao-chau*, Bartholomew's atlases *Kiau-chau*, Statesman's Year-Book, 1913. *Kiaochow*, Encyclopedia Britannica, eleventh edition. *Kiao-Chou*, Geographical Journal, vol. 27, 1906, Index. *Kiao-chou*, Ibid., vol. 31, 1908, Index. *Kiauchou*, Ibid., vol. 36, 1910, Index.

Note that we find three spellings (and further search might reveal others) in recent volumes of the *Journal* of the Royal Geographical Society, although this society some thirty years ago adopted an ostensibly uniform system of orthography for native place-names, which has been accepted by numerous other societies and institutions throughout the English-speaking world; and, what is more surprising, none of these three spellings agree with any found in the leading British atlases. To make matters worse, there are sundry German spellings, which were not inappropriate for general use so long as the region in question was a German dependency, e. g.: *Kiautschou*, Meyers Konversations-Lexicon, sixth edition. *Kiau-Tschou*, Stieler's Atlas.

While this case is fairly typical of the confusion that prevails as to the spelling of place-names in China and certain other countries, there are other cases in which divergent spellings lead to more serious results than are to be apprehended from the one above noted. We refer to names in which the *initial* letters are variable, e. g., Tsangpo—Sanpu; or, again, those in which the discrepancies occur near enough to the beginning of the name to materially affect the location of the latter in an alphabetically arranged list, e. g., Lhasa—Lassa. Such cases are the despair of index-makers; because, while it is possible by the use of numerous cross-references to take account of all the recognized spellings, the indexer is confronted with the difficult problem of deciding which form shall be treated as the principal entry in his index.

Engineering

Concrete Roads.—Concrete road construction has increased from 364,000 square yards laid in 1909 to 19,200,000 square yards, which it is estimated has been laid during the season of 1914. This would be sufficient, were it put down in a single stretch, to form a roadway four yards wide and 2,700 miles long.

Trial Trip of the "Moreno."—The dreadnought "Moreno," built by the Fore River Ship and Engine Building Corporation for Argentina, has passed her speed test and exceeded her contract stipulation, by maintaining an average speed of 22.5 knots without being pushed to her speed limit.

Naming Tunnels After Engineers.—A well-deserved and too seldom accorded honor is to be given to engineers by the Baltimore and Ohio Railroad. The four tunnels on the Magnolia Cut-off between Orleans and Little Cacaton, West Virginia, are to be named after four of the road's chief engineers: James L. Randolph, J. M. Graham, D. D. Carothers and Francis Lee Stewart.

Panama Canal Trade.—An aggregate of 583,949 tons of cargo was carried by 113 vessels through the Panama Canal during the two months from August 15th to October 15th. The heaviest trade has been that between Atlantic and Pacific ports of the United States. It embraced 49 passages and constituted 44 per cent of the traffic through the canal and 50 per cent of the total freight.

New United States Naval Drydock.—The Union Iron Works, San Francisco, is under contract with the Navy Department to build a drydock 1,096 feet long by 110 feet wide with 40 feet depth over the sill, which is to be used by United States naval vessels in the Pacific. The department has guaranteed the builders a sufficient amount of business to bring a return of $50,000 a year for six years.

Mesquite Wood for Paving.—So scarce have mesquite wood blocks become that the city of San Antonio, Texas, has abandoned the plan of paving 250,000 square yards of its streets with this wood. Mesquite is a wood that is almost indestructible, very hard, tough and dense. In the Southwest, for many years, it has been used for the sills of adobe houses; it makes an excellent material for street paving.

The New French Four-and-one-eighth-inch Field Gun.—Reports from the seat of war speak of the effective work done by the new French 4 1/8-inch field gun, manufactured by the Schneider works. The gun is much more powerful than the 75-millimeter gun of the French and it has a range of 8¼ miles. This is over a mile farther than that of the German 152-millimeter siege gun. Except for its greater caliber, the new piece is very much like the 75-millimeter gun and retains all the rapidity of fire, handiness and accuracy of that piece.

The Largest Chain Drive.—The largest chain drive in existence, three times greater in size than any previously built, is to be found at the Ox Bow Power Plant, on Snake River, Copperfield, Oregon. The plant consists of a 3,600 kilowatt generator, operated by two water-wheel units, each consisting of two pairs of water-wheels of the 48-inch horizontal type, operating under a 21-foot head. The speed of the water-wheels is 147 revolutions per minute, and each water-wheel unit is connected to the generator by four Morse chains, each 21 inches wide, the sprockets on the line shafting having a 2-inch pitch, and the shaft centers being 10 feet apart.

United States Aerial-defense Gun.—The Ordnance Department of the Army has developed a high-angle fire gun, based on experiments with the Deport gun illustrated in the first war issue of the SCIENTIFIC AMERICAN, which has a split trail and a recoil system especially adapted to firing at a high angle. As the result of important experiments, the Ordnance Department now possesses a gun which it thinks will be superior to the French gun, justly celebrated for its speed and handiness, which will be eminently suited for firing at aeroplanes. The new gun is of greater range horizontally, and it will be possible without moving the carriage to fire the gun laterally at a greater angle than with the present carriage.

Ocean-going Submarines for the Germans.—A correspondent of one of the London daily papers at Copenhagen, speaks of a report from Hamburg to the effect that two unusually large submarines have been completed for the German navy and are making trial trips at the mouth of the Elbe. According to the report these submarines are four times the size of any existing vessels of this type, with a radius of action which will enable them to keep at sea for forty days without having to replenish their oil tanks and stock of stores, or even have recourse to the submarine tender. This would mean a submarine running into the thousands of tons displacement. Such vessels will be built, and at no very distant date. It is quite conceivable that, in view of the enormous offensive power of such a craft, the Germans may be springing a surprise in underwater craft similar to that which they gave with the 16-inch gun in siege artillery.

Science

Survey of Southern Palestine.—A considerable amount of surveying and exploration has recently been done along the southern frontier of Palestine under the auspices of the Palestine Exploration Fund by parties headed by Capt. S. F. Newcombe, R.E., and including two archæologists from the British Museum. Five parties surveyed and mapped the whole border region except a small area around Akaba, where the Turkish authorities refused the necessary permission, and the trigonometrical survey of Palestine was connected up with that of Egypt.

Wolfram, an important source of tungsten, is said to be quite widely distributed through Siam, where its production on a commercial scale is a recent development. According to a recent consular report, it was long known to the Chinese tin-miners in Siam as "dead ore," and supposed to be of no value, until some of the ore was taken to Singapore for analysis and found to be wolfram. Great heaps of this supposedly worthless material had been left by the tin-miners in the mountains of Nakawn Sitamarat (Nakon Sri Tamarat), in the Malay peninsula.

Eye Injuries from Artificial Fertilizers.—In order to test the supposed injurious effects of artificial fertilizers upon the human eye, some experiments with rabbits were recently carried out by J. Eickmeyer, of the University of Rostock. It was found that superphosphates produce a slight conjunctivitis and a transient cloudiness of the cornea; Thomas slag produced a marked conjunctivitis with a transient turbidity of the cornea and residual scars; calcium cyanamid caused a marked neurotic conjunctivitis and also keratitis. When applied to the cornea as a paste these substances showed marked toxicity.

Watering Shade Trees in City Streets.—A very ingenious and practical device for assuring the trees on city sidewalks a sufficient supply of water, no matter how dry the season and how hard baked the earth, has recently been put in operation in Strasburg by Mr. Sauer, the city tree inspector. It consists of a tube of iron or lead bent into the form of a ring large enough to encircle the stem of the tree. The earth is removed so that this ring may be placed just above the roots, and is then filled in again, leaving the end of a pipe connecting with the ring projecting above the surface of the ground. The top of the ring is pierced with a large number of small holes, and a tin cover or shield prevents these from becoming stopped up with earth. By means of a funnel in the protruding end of the pipe any desired amount of water may be supplied to the roots without waste or loss of time. A further advantage, according to *Prometheus*, is the ventilation thus secured of the earth in the vicinity of the roots.

Easter Island, in the South Pacific, is one of those out-of-the-way places that intermittently attract the attention of the world, on the occasion of the rare visits paid them by explorers and travelers. The island is famous for two things, first, for its excessive isolation, and, second, for its colossal stone images and other relics of a forgotten and unknown race. This spot has recently come into special prominence on account of the adventures of a small expedition led by an Englishman, W. Scoresby Routledge, and including an archæologist and a geologist from the British Museum, which set out two years ago, and after much incidental exploring *en route*, ultimately arrived at Easter Island, where a thorough study of the archæological problems of the island was to be made. Hardly had these investigations been begun when a serious outbreak of the natives occurred. As there was only one European in the island besides the members of the English expedition, and the natives numbered about 250, the situation was extremely serious for a time. The opportune arrival of a Chilean man-of-war put an end to the trouble and at last account (August 10th) explorations were again progressing satisfactorily. The island has also been brought into prominence recently by the writings of Dr Walter Knoche, the German director of the Chilean meteorological service, who visited this remote Chilean possession in April, 1911, for the purpose of establishing a meteorological and seismological station. Perhaps the most remarkable fact in connection with Dr Knoche's expedition was that a sojourn of only twelve days in the island should have furnished him material for no less than eight important memoirs, published part in Chile and part in Germany during the years 1912-14, and embracing such diverse topics as the meteorology of the island, its songs and folklore, its ethnology, archæology and folklore. After Dr. Knoche's departure the observatory was maintained for a year by Senor E. Martinez, of the Chilean meteorological service. His observations have been published *in extenso* by the Chilean government, and are accompanied by memoirs on the geology, botany, seismology, etc., of the island, by experts in these various subjects. Perhaps the most interesting fact brought out in this publication is the very slight seismicity of the island, as compared with the high seismicity of the Chilean-Peruvian coast.

Automobile

Ambulance Cars.—Many pleasure cars in England have been fitted up as ambulances, both for home use and with the army, and in many cases this is easily accomplished. A light ambulance body is fitted, and this has a special channeled platform, into which the runners of two regulation stretchers slide, a tailboard to keep all fixed, front curtains to screen the interior, and outside seats for driver and attendant. In this design the canvas canopy, which is like a shelter tent, can be rolled up, the frame is detachable so as to allow the platform to be used for the transport of goods and stores if required.

Automobile Situation in India.—According to statements made by a man prominent in French automobile circles, business is progressing in India, and it is estimated that the total number of motor vehicles including pleasure cars, motorcycles and power wagons actually in use in India number over 15,000. More than 50 per cent of this number are of French make. Good roads are frequently met with, and it is possible to make a 1,200-mile trip through the country from Calcutta to Peshawar without any special difficulty. This route allows of visiting all the historic cities in the north of India and numerous garages lie along the route and afford a good supply of gasoline and oil. Gasoline sells for .42 cents a gallon. The best season for automobile touring is from November to February.

All-Weather Bodies on the Increase. The number of automobile owners who drive their cars the year around grows apace. And this draws attention to the fact that the type of body which goes under the not altogether euphonous name "all-weather" is coming into greater demand. The perfection of such bodies to the point where inexpert, and not so inexpert, rattles have been eliminated has had much to do with their increasing popularity. At the same time, quite a number of car makers now are sending their vehicles out with open touring body and also a detachable top of the semi-permanent type which may be lifted into place and become part of the car directly the snow flies. Naturally, these detachable tops have a wide appeal, for the cost is not high.

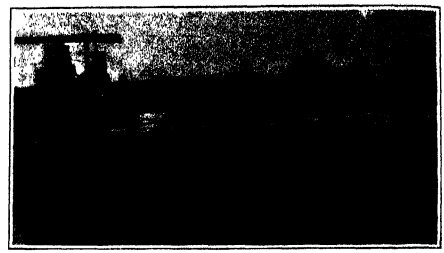
Increase in Small Electric Delivery Wagons.—Although the low-price electric passenger vehicle which it is said now is under contemplation by Thomas A. Edison and Henry Ford still remains beneath the horizon, low-priced electric freight vehicles bid fair soon to be common. Within the past few months two vehicles of the kind have appeared on the market. One of them is a four wheeler and the other has but three wheels. Both are comparatively light in construction and are designed for the cheap and efficient transportation of small parcels. That there is a market for vehicles of the kind there can be no gainsaying for the cost of electric current steadily is decreasing and the inherent simplicity of the cars themselves is their own most potent factor of appeal.

Motor Car Factories in Germany. Most of the motor car manufacturers in Germany are working twenty-four hours each day in an endeavor to keep up with the demands of the army officials, although several report considerable private demand. In most of these factories there is great difficulty in carrying on the work as so many of their workmen have been called to the front, and it is extremely hard to secure skilled labor anywhere in the country now. In some cases the employees of shops engaged on government contracts have been sent back to their work in uniform to enable the work in hand to be completed. A number of factories have been taken over entirely by the government, and some nearer to the scene of activities have been devoted entirely to repairing damages sustained at the front. This is particularly the case of Belgian factories. Besides the scarcity of labor the difficulties encountered are in securing supplies of rubber for tires, and in the transportation of materials required, even in the case of government contracts.

At a Recent Meeting of the British Institute of Automobile Engineers a member delivered a scathing criticism of the manufacturers, which was not challenged, because they relied on the continent so largely for component parts, many of these coming from Belgium, Germany and Switzerland. These supplies are now unattainable and particular mention was made of the difficulties of commercial vehicle manufacturers who have been obtaining the steel castings for their wheels from Germany. The German magneto has also been very largely used in England. Special stress was laid on the inaccuracy of British drop forgings, and it was stated that it was impossible to get certain types of mild steel steering forks except on the continent. The faults of British designers was laid to the lack of really practical men and modern plants at their technical schools and colleges. This dependence of British automobile manufacturers on the continent for supplies of components has become a very serious matter when there is such a pressure for heavy commercial vehicles for army use that even the motor omnibuses have been pressed into service, especially as it makes the possibilities of replacement doubtful.



Drying onion seed in California.



Threshing onion seed.

The Seed Supply and the War

Making Up the Shortage on Our Own Farms

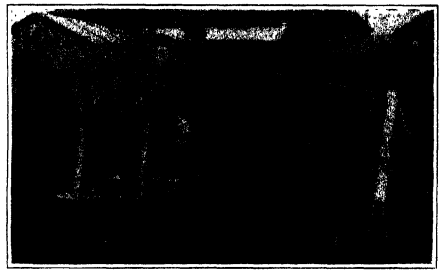
By Guy E. Mitchell

WILL the bumper crop of this year be followed by a lean one next year? Thousands of tons of seeds which are ordinarily imported from Germany, France, and Belgium will never be shipped, indeed most of it will never be harvested, on account of the war. As a consequence of this shortage of the seed supply the wise farmers of the United States, acting under advice of the Department of Agriculture, have been saving their own field and vegetable seeds.

The greater part of our sugar beet seed comes from Germany and France, and the war is resulting in total destruction of a great part of the sugar beet crop in parts of France, while in Germany the shortage of help prevents the harvesting of the seed. Our sugar beet growers in Michigan, Colorado, California, and the other States in the sugar beet area, will be seriously hampered because of the shortage of seed. Then there are crimson clover and hairy vetch two plants largely used as cover crops and as soil renewers, both of which are largely dependent on the seed brought from Europe. Farmers in the South and West annually sow large quantities of these two forage plants, the growing plants being used as pasture during the winter and cut and dried for hay, or plowed under as green manure in the spring. Already the cutting off of the supply of seed from Europe has caused marked advances in the prices of supplies in the hands of seedsmen in this country, and inability to obtain further supplies and it is believed that it will either be necessary for American farmers to save seed from their own crops or to abandon the use of the crop altogether for a time.

While there has been a note of alarm in a number of the large metropolitan newspapers as well as in the country press, the seed specialists of the Government have not shown so much concern over the seed situation, for while it is admitted that there will be a shortage in seed, the seeds that we import from Europe carrot, celery, endive, parsley, spinach, radish and some kinds of cabbage seed, and other small vegetable, also many of our flower seed, such as pansies, poppy, and verbena *can all* readily be saved by the individual grower. The only really alarming feature is that confronting the sugar beet grower. The advice given the American farmer to grow his own seed does not apply to the sugar beet grower for it requires two years in which to grow the beet before securing seed.

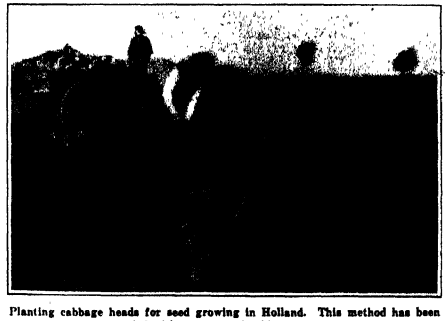
It is a fact nevertheless, that while the great bulk of our seeds are already grown in the United States—thousands and thousands of acres are planted to seed the cutting off of importations will tend to raise the price of some seed and make the dealers scurry to supply the demand for next year, for when planting time comes many farmers will be found, to whom it never occurred to save their own seed.



Thresher for separating watermelon seeds from the pulp.



In one of our watermelon seed washeries.



Planting cabbage heads for seed growing in Holland. This method has been tried without success in this country.

There is sharp competition between some classes of seed of American and foreign origin, but in most cases the American seed is the better. Machinery in competition with cheap labor of Europe has helped our people to keep at home money that has been sent to Europe for seed. A few years ago possibly two decades—we sent to Germany for all our lettuce seed, because it was then believed that our climate was not suitable for lettuce seed growing, and because labor abroad was cheaper. But the climate was found—in California — and American inventive genius followed, so that to-day, instead of buying lettuce seed from Europe, we are supplying not only ourselves, but Europe as well. In Europe, watermelon, cucumber, and canteloupe seed are extracted by hand, the work being done by women, who work from six in the morning until eight at night, diligently scooping out the seeds with a spoon, for 25 cents a day. Here in this country, however, the watermelon thresher does the work and better. The machine is mounted in a motor truck and run up and down the rows. The melons are thrown into a hopper, similar to that on a cider press. Knives chop the melons or cucumbers and the pieces are then crushed between rollers. The mass then passes to a revolving drum, which separates the seed from the pulp. These seeds with some adhering pulp are dumped into barrels and allowed to ferment in order to loosen the pulp from the seeds, later to be washed and dried for shipment. On some small farms the thresher is stationary and operated by a horse. One of these machines operated by one man can do as much work in a single day as that performed in Europe by ten women, and do it better.

What lesson does the American farmer learn from the present seed situation? Let him do for himself with his vegetable and flower seeds what his father and his grandfather did before him before the days of seed dealers—save the seed for himself. The Department of Agriculture is anxious to have the farmer grow his own seed, and return to the independence of earlier days, but grow them intelligently, selecting the better and stronger plants for seed. The seed, after all, is half the crop, and if the shortage caused by the war does nothing more than induce the farmer of this country to save his seed with the utmost care it will result, after a few years, in a gradual increased yield in American crops.

Antiseptic Drinking Fountain.—William C. West, of Kansas City, Mo., in a patent, No. 1,099,002, provides a drinking fountain with a series of cups which are movable successively through a sterilizing liquid.

Mines in the North Sea

THE submarine mine, whether anchored or floating, has added, in the present war, to the reputation which it gained during the war between Russia and Japan. As was to be expected, most of the losses through mines have occurred in the North Sea; but they have not by any means been confined to those waters. In the Adriatic, the Black Sea, the Baltic, and in far eastern waters at Kiao-Chou, this deadly weapon has taken a terrible toll of the fleets of the warring nations.

Mines are of three types—first, ground mines, which are usually of great size and laid directly on the bottom; second, anchored mines, which are attached by a cable to a weight on the bottom, and are designed to float at a predetermined depth, such that they will touch and be detonated by passing ships; and third, floating mines, which are dropped on the surface of the water. It is probable that the majority of the mines which have been planted during this war are of the second or anchored type, arranged to be discharged automatically when they are struck by a passing vessel.

It frequently happens that during heavy storms the mines break loose from their moorings and are ultimately cast upon the adjacent coast. Such a mine is shown in the accompanying photograph, which was taken on the east coast of England on the shores of the County of Suffolk. The mine is a large one, capable of containing anywhere between 300 and 500 pounds of explosive. The group standing by the mine includes two of the justly-famous Boy Scouts, who have been rendering excellent service among those of the warring nations in which the Boy Scout movement is represented.



Photograph by Underwood & Underwood

A mine broken away from its moorings and washed up on the east coast of England.

Loss of the Pre-dreadnought "Bulwark"

EARLY in the morning of November 29th the British pre dreadnought "Bulwark" was blown up in Sheerness Harbor in the Thames at a point about thirty-five miles from London. Practically the whole of the ship's complement of 750 men was lost, the ship going down within three minutes after the explosion and only fourteen of the crew being saved.

Of the three possible causes of her loss—a mine, submarine attack, or an internal explosion—the last named has been generally accepted as the most probable. No mine-laying by the enemy would be possible at a point so far up the estuary which leads to Great Britain's most important city. In view of the fact that the Thames is heavily mined, it would be impossible for a submarine of the ordinary type to have made its way so far up the river, moreover, the fact that the Germans have made no claim to the destruction of the "Bulwark" coupled with the other difficulties above mentioned, leads to the conclusion that the ship was lost through the explosion of her magazine.

Even if this theory be adopted, the loss of the ship is still shrouded with mystery; for although the "Bulwark" was an old battleship, her design having been gotten out some sixteen years ago, we understand that in the matter of powder inspection and the safeguards to preserve the magazines at an even temperature, the ship was thoroughly up to date.

It is true that the French navy lost one of its finest battleships, the "Liberté," through the deterioration and spontaneous combustion of its powder; but it has since developed that the powder aboard the "Liberté" was of inferior and unstable quality and not comparable in point of safety with the powder carried by the British navy, which for many years past has proved to be thoroughly stable and reliable. In commenting upon the disaster, Lord Charles Beresford said: "It is certain that the magazine must have exploded, but I cannot imagine how it happened. Good cordite does not explode without a detonator, and inferior cordite is excluded by frequent tests. There was a fire a while ago within the magazine of the battleship "Revenge" Sailors quenched it and the magazine did not explode. The magazine of the "Bulwark" was in a very safe position and was protected by every modern device. Possibly a shell or fuse was dropped, but even this ought not to have exploded the magazine."

The "Bulwark" was a pre-dreadnought of early design, she and her sisters, the "London" and "Venerable," having been laid down in 1898 to 1899. She was of 15,000 tons displacement and could make 18½ knots. Her protection was very light for a battleship, the belt being only 9 inches thick amidships. Her battery consisted of four of the old 40-caliber 12-inch guns and twelve 45-caliber 6 inch, and she carried four 18-inch submerged torpedo tubes.

The loss of this ship does not sensibly affect the strength of the first fighting line of the British navy—a fact which will be readily appreciated when we compare her fighting efficiency with that of the "Audacious," a thoroughly modern dreadnought, recently lost off the Irish coast. The "Bulwark" in a single broadside fired a weight of 2 tons of metal, the broadside of the "Audacious" weighed 6½ tons. The total energy of the "Bulwark's" broadside, including the 12 inch and 6-inch guns, was 186,000 foot tons, whereas the "Audacious" fired a broadside of 646,500 foot-tons. The 40-caliber 12-inch guns of the "Bulwark" could penetrate 16 inches of armor at 5,000 yards, but at the same range the 13½-inch guns of the "Audacious" could pass through 22 inches of armor. The 12 inch shell of the "Bulwark" weighed 850 pounds; the 13½-inch shell of the "Audacious" weighed 1,250 pounds, and because of the fact that it contained a far heavier charge of high explosive the shell had enormously greater destructive power.



Designed 1898. Tonnage, 15,000. Speed, 18½ knots. Belt, 9-inch. Guns: Four 12-inch, twelve 6-inch. Torpedo tubes, four 18-inch.

British pre-dreadnought "Bulwark," lost in the Thames by internal explosion.

The Crocker Land Expedition

ON June 24th 1906, explorer Peary thought he saw through glasses from a mountain peak in Grant Land "the faint white summits of a distant land" which he named Crocker Land and which has since made its appearance with or without a note of interrogation on most maps of the Arctic regions. In fact the belief has prevailed rather widely that Peary saw the eastern margin of a vast continent or archipelago, filling most of the area that is now blank on Arctic maps. In the autumn of 1913, when Vilkitskii's discovery of Nicholas II Land, near the Siberian coast, was announced, certain wild statements were published in the newspapers as to the probability of this discovery constituting part of the hypothetical continent, although reference to a map of the routes followed by polar explorers would have shown the authors of these statements that, if they were correct, Nansen's expedition in the "Fram" must have drifted over dry land.

In July, 1913, an American expedition sailed from New York with the object of visiting and exploring Crocker Land. It was backed, financially and otherwise, by a number of institutions and individuals, but especially by the American Museum of Natural History, and was commanded by Donald B. MacMillan. This party spent the winter of 1913-1914 at Etah, Greenland, and in the following spring a sledging expedition was made by the leader and Ensign Fitzhugh Green, U.S.N., over the sea ice to a distance of one hundred and twenty-five miles northwest of Cape Thomas Hubbard, i. e., to the supposed location of Crocker Land. The main results of this journey have just reached the world, the principal one being that Crocker Land does not exist. The sledge journey occupied two months, and appears to have been exceptionally difficult and dangerous. All details now available were published on November 25th in the New York *Tribune*, which is the accredited mouthpiece of the expedition. The news came by a somewhat indirect route, and not from MacMillan himself, whose narrative will probably not reach this country until next April or May, unless the attempts which the expedition has been making to send wireless messages from its base at Etah should prove successful before that time.

It is understood that this expedition the only one from the United States now engaged in polar exploration will henceforth concentrate its energies upon a journey into the interior of Greenland.

California Imports Timber.—Hardwoods are not abundant on the Pacific coast, notwithstanding that section of the country is so richly endowed with other classes of timber, and it is reported that much of the oak consumed on the Pacific coast is brought from the eastern countries of Asia.

Strategic Moves of the War

Letter from the Military Correspondent of the Scientific American, December 4th, 1914

The Campaign in France.

IN the western field of fighting, we have had the remarkable situation of the armies of four nations confronting each other for two weeks without any extensive operations. The opposing lines include a total of approximately 4,000,000 men, yet neither side is prepared to force the fighting on the scale that is necessary to decide the question of victory.

For the Germans the compelling reason is evidently a strategic one. They are making their greatest effort just now in Russia. Consequently, they are rushing to the east every available man and are depleting the western lines to the minimum force that can hold the Allies back.

Warfare is a game of wits as well as a contest of military strength. The important thing is to have the strength where needed, when needed. The conduct of the campaign involves a study not only of the enemy's resources, but of the mode of thought of his generals. The bold strategy of the German campaign is based on both.

The German General Staff seems to have misjudged the difficulties in their first dash toward Paris. Both the Belgian resistance and that of the British proved unexpected obstacles. The shattering force that was planned for this blow was avoided by the sound strategic plan of Gen. Joffre and his associates.

History and national temperament called for the French to rush to meet the invader. On the contrary, though, and in spite of popular clamor, the French army retreated again and again, allowing the German blow to be "wasted in the air." When the hardships of forced marches and the shortage of food and ammunition had taken the edge off of the German fighting strength, the French struck back in the battle of the Marne, from September 5th to 12th. The Germans made good their retreat, but were forced to fall back fifty miles to the Aisne to reform their lines.

The second great strategic move of the war was the effort of the French and British to turn the German flank between the Oise and the North Sea. From September 15th to the capture of Antwerp on October 9th, the fighting in the west centered on the efforts of the Allies to turn the German right flank and on the efforts of the latter to prevent this.

After the capture of Antwerp and the release of the German forces held for this purpose, the Allies gave their energies to checking the impending German attacks. Their lines were reformed, and the British troops were moved to Belgium, where they would be nearer to their base of supplies. For five weeks the Germans battered at the lines between Arras and the sea in the effort to break through to a Channel port from which they could threaten the British commerce with submarine raids. It was only after repeated repulses with large losses that this project was given up, probably also due to the critical position of the German army on the Polish border.

While Germany is engaged on her present great effort against the Russians her campaign in the west must naturally slacken. The failure of the Allies to take advantage of this temporary weakening of the German strength is just what the latter have been counting on, and enables them to give extra strength to their campaign against Russia.

The fighting in France during the week has consisted entirely of bombardments and minor attacks to feel out the enemy's strength. These were made by only a few battalions and were rarely pushed farther than the first line of trenches. In most cases they were repulsed. The exchange of these gains is slightly in favor of the French, but none of them make any material difference in general positions.

The battle line now follows the Yser River and Canal in Belgium to Ypres. There it runs south through Armentieres, La Bassée, Lens, east of Arras, west of Bapaume and Chaulnes, through Roye, Ribecourt and Tracy-le-Val, and north of Soissons. For a ten-mile stretch at Vailly the Germans hold the north bank of the Aisne, while at Vendresse and Craonne the French have advanced three miles from the river.

South of the Aisne the line skirts Rheims at a distance of four miles and runs through Nauroy, Souain, Vienne-le-Chateau, Four-de-Paris, and then circles Verdun at a distance of eight miles. East of the Meuse the line parallels the river at a distance of eight miles until it bends back sharply from Hattonchatel to St. Mihiel, where the Germans hold Chauvoncourt, immediately west of the river. From here the line bends eastward through Apremont and Thiaucourt to Pagny on the Moselle.

From here southeast to the Vosges the line lies just south of the border. The French now hold the central passes in the Vosges Mountains, while in the south they have gained a ten-mile strip of Upper Alsace, including Thann and Altkirch.

Whatever may be the result of the fighting in Russia, it seems evident that active operations will soon be resumed in the west. If the Germans succeed in the east they will take advantage of it to strike their next blow in the west. If the Russians win out in the present fighting, the Germans will need special efforts to check the Russian invasion. The western Allies would then have a chance to catch their opponents at a disadvantage.

The two most important parts of the western battle line are the flanks. The natural line of attack for the Germans is in the vicinity of Nancy, where they would have the services of their great rail system in Lorraine for moving and supplying the armies. If the Germans are too weak for a general campaign against the French army they may confine their efforts, as before, to a campaign for the capture of Dunkirk or Calais.

For the Allies, the natural line of advance is along the seacoast. Here they would gain the co-operation of the naval vessels and would have the supply of part of their armies simplified by the water transportation Great Britain would profit by this on account of its effect on the German submarines while Belgium is clamoring for a campaign to recover her territory. It is probable that the resumption of offensive operations by the Allies will be signalized by a further advance into Alsace, but it is considered most probable that this would be only a large scale diversion to draw the German troops southward in preparation for the main advance along the north coast.

The Campaign in Russia.

The German campaign in Poland has been accompanied by varying fortunes that make it the most interesting of the entire war. Their first effort was to draw the Russians southwest toward Cracow and Silesia. Then they let loose their new armies from Thorn to cut off the Russians from Warsaw and thus to compromise their position.

The successes at Kutno and Grabow in the middle of November enabled the Germans to push forward beyond Lodz and Lowicz until they reached the main railroad running from Warsaw to Czenstochowa. Meanwhile the Russians had drawn back their troops from the Warthe and had rushed forward new corps from Warsaw and Brest-Litovsk.

The Warsaw army held the Germans in front while on November 23rd the Russians east of the Warthe moved northward to cut them off. At Kolunski, where the branch railroad to Lodz joins the main Warsaw line, the Russians cut off part of the German advance guard. The Germans fell back to Tuszyn and Brzezny on a line twelve miles southeast of Lodz, where they were again defeated.

At Zdunskawola and Szadek, six and eight miles east of Sieradz, the German line held fast against the Russian attacks and checked the project to cut off the troops near Lodz. The latter fell back twelve miles farther to a line through Lutomiersk, Zgierz, Strykow, and Glowno, where they checked the Russian attacks.

Meanwhile both armies pushed forward their right flanks. The Germans concentrated a force at Wielun, half way between Kalisz and Czenstochowa, and sent them forward to catch the Russians while weakened by the movement of troops to the north. This attack was repulsed and the Russians were left free to prosecute their campaign in both the Sdunskawola and the Cracow district.

The Russian move was similar to the one that gained them success in the battle of the Vistula in October. From Novo Georgievsk they sent forward a strong Cossack army that advanced along the south bank of the Vistula as far as Gombin, ten miles south of Plock. Here they were checked by the German reinforcements, but their advanced position forced the Germans to abandon Lowicz and to fall back ten miles to a line through Sobota. Here they have strengthened their line and are resisting energetic attacks by the Russians.

On December 1st the Russians showed a still wider flanking move in their occupation of Plock on the Vistula River, half way between Warsaw and the German border. The advantage that they hold in their large number of cavalry divisions enables them to spare a strong mobile force for a move north of the Vistula to threaten the German communications from this side.

In the Cracow district the Russians checked the Austrian advance on the line through Pilicia, Wolbrom, and Miechow. In Galicia, the Russians made a notable gain and have advanced from Tarnow to Bochnia, on the Raba River twenty-eight miles from Cracow. Farther south, they have gained the headwaters of the Donajec River and have crossed into Hungary. At Bartfeld, Meso laborcz, and Ussok the Cossack detachments are beginning to debouch into the valleyheads of the Theiss River.

In East Prussia there has been no change during the week. Both sides seems to have diverted a part of their strength to the more important campaign in Poland.

The fighting in the east now forms practically one big battle from the Carpathians to the Baltic Sea. The outcome of the fighting in any one district, accordingly, influences that in all of the others. The critical point is, however, between Warsaw and Thorn. If the Germans win out here, the Russians will have to abandon their campaign against Cracow in order to make a hurried retreat to the shelter of the Vistula River to reorganize their armies. If the Russians win in the fighting south of Plock, the Germans will have to fall back rapidly to their border for a like refitting and reorganization.

A Gyroscopic, Motor-driven Unicycle

THE idea of a single wheeled vehicle is by no means new. A foot-propelled unicycle was described in the SCIENTIFIC AMERICAN over thirty years ago, and ten years ago we described a motor-driven unicycle, which had then actually been built, but had not been tried out on the road. The novelty in the motor car shown on our front page, this week lies not in the fact that it is a one-wheeled vehicle, but that it is stabilized by a gyroscope.

The machine has not been built, but the design has been offered by one of the readers of the SCIENTIFIC AMERICAN as a suggestion to some enterprising inventor. If the unicycle is ever to prove a success, the gyroscope would undoubtedly prove serviceable in giving the vehicle stability.

As shown in the illustration, the idea is to build a large wheel with a track on its periphery and mount the car inside the wheel in a frame provided with three rollers adapted to run on the track. The motor is situated in the bottom of the car and drives the bottom roller by friction. The car tends ever to ride up the track inside the wheel, throwing the center of gravity of the wheel forward of its geometric center, and thus causing it to revolve. The gyroscope, in the bottom of the car, consists of two wheels traveling in opposite directions. It maintains the wheel normally in vertical position. When it is desired to make a turn the car body is displaced laterally with respect to the frame in which it is mounted. This causes the wheel to lean, and hence to turn accordingly. In the motor-driven unicycle we described ten years ago, steering was effected in a similar way, except that the driver himself swayed his body to one side or the other in order to tilt the wheel. In the present machine, as the gyroscope maintains the car body in upright position, the movement of the driver will have practically no effect upon the vehicle as a whole. But by operating the steering wheel, he may tip the big traction wheel to one side or the other. The gyroscope makes side props unnecessary when the vehicle stops.

A Prize for a Trade-mark

E. MOULIÉ, a manufacturer of perfumes in San Diego, Cal., who is a believer in trade-marks, and who is about to introduce some new products, is offering a $20 gold piece as a prize to be awarded to the person who suggests the best trade-mark for perfumes made from San Diego flowers, and the conditions are as follows:

The trade-mark is for "San Diego Flower Perfumes," and the trade-mark name must be limited to three words at most. There is no need of using "San Diego" nor "flower perfumes" nor any name at all. The trade-mark is more intended to advertise San Diego than the goods it will cover, because Mr. E. Moulié's registered trade-mark "Maiden's Dream," covering the full line of his production, has been known for one third of a century; therefore, the trade-mark name of this contest must be appropriate and suggestive of San Diego's beauty.

This contest is open to everyone, and as many suggestions can be sent as desired. The suggestions are to be sent to E. Moulié, 724 Broadway, San Diego, Cal., before December 15th, and the decision as to the best trade-mark and the winner of the prize will be made by Messrs. Munn & Co. immediately thereafter.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Organized Efforts to Bring About Peace

To the Editor of the SCIENTIFIC AMERICAN:

The publicity given the various points of view on the war situation and the causes leading up to it, and statements put forward by each side as to the responsibility for the present cataclysm, do not, with but few exceptions, suggest any remedy or any tangible method of dealing with present and possible future conditions toward bringing to an end the awful destruction of life and property now shocking the civilized world.

Is it not now time that active thought and attention be given to what is before, rather than to what is irretrievably of the past?

Everyone stands horrified at the war spectacle, yet there is no organized effort openly discussed whereby public opinion can make itself felt and thus become a potential factor in possibly shortening the war. That this unexpressed public opinion is on this question a mighty leverage with officials high in authority, is indicated by the appeals from the belligerent countries and their advocates here for the moral support of the people of this and other neutral countries.

It is idle to say that if properly organized the overwhelming public sentiment against the continuation of the present unbearable conditions throughout Europe would not hasten the termination of the conflict. The time may not be yet ripe for peace to become established on a sure and stable foundation; but let us ask what better opportunity for an earnest effort toward this end will be possible after one or more of the great nations are reduced to a point of exhaustion? When such a point is reached, then, by the very process of reapportioning and surrendering territory under the old "spoils-of-war" method, is not the sure foundation thereby laid for another cataclysm just as soon as the subdued people can recover sufficient strength for the conflict?

Is it not now pertinent, indeed the duty of all from the history of the past, to look forward and ask ourselves whether the last conditions of all the countries at war will not, if the contest goes on to exhaustion, be worse than the first? Has national hatred there, combined with the brutalities of war, reached a point where nothing can induce the belligerents to stop and listen and look to some better way for adjusting differences than to permit the greatest of the world's wars to be fought out to the bitter end and under the relentless horrors of barbarism?

It is gratifying to observe those with such divergent views on the question, as for instance Col Roosevelt and Dr. Nicholas Murray Butler, agreeing in the main with that versatile publicist, Lord Bryce, that an effective prevention of future wars must rest on a binding mediation agreement between nations, not only as to submitting differences to arbitration, but also to the enforcement of the conditions by all against any country which may disregard its obligations.

While this is a delicate subject to work out under present conditions, should twenty-five or thirty favorably well-known and earnest publicists, inspired by a common purpose, get around a table, and the energies of the country look and work forward to accomplishing this end, I believe that a plan could be devised which would at once enlist the co-operation of the people of other neutral countries and make such a result as practicable as the need is urgent.

A well-organized committee could readily be formed of which every name would carry the weight of *international influence*, and would inspire confidence in the assurance of wise and discreet action in dealing with the vast interests and intricate questions involved.

Is it not worthy of trial? Or shall the country and the world stand aghast, impotent, and helpless, continuing to discuss causes, when the present and future results are of such colossal magnitude, not only to the people of this and of all countries, but to the very heart and fiber of civilization itself?

FREDERICK W. KELSEY.

The Institute of Human Paleontology, under construction in Paris, lies not far from the university quarter. It is endowed by the Prince of Monaco. The institution is to be devoted to researches upon questions relating to prehistoric man and his evolution, and numerous laboratories will be equipped for this purpose. The building will also contain space for numerous collections of prehistoric human remains, lecture rooms, and the like. Handsome bas-reliefs showing primitive man in various groups decorate the outside of the new structure.

The Work and Needs of the United States Patent Office*

By Thomas Ewing, Commissioner of Patents

MR. PRESIDENT and Gentlemen of the Patent Bar Association: When I first took hold in Washington, in August, 1913, I found that there were a great many applications which had been pending for a long time. A count made later on showed that on June 30th, 1914, there were pending over 31,000 applications which had been in the office more than two years. Of these, 4,231 had been pending over five years and 241 ten years or longer. There were 52 cases that had been in the Office more than fifteen years, and one old parent case with a litter of eight divisions has been pending since 1880.

Bringing Amended Cases Up to Date.

I issued an order that no amendment should be entered in a case which had been pending in the Office for fifteen years without being first called to my attention. The period has been lowered since, and on December 1st the order will apply to all cases which have been pending in the Office for five years or longer.

If an amendment is filed in such a case which puts it in condition for allowance or final rejection, it will be accepted, but if the amendment does neither of these two things as, for example, where an applicant undertakes to put in new claims, that application is hooked I do not object to a little play, but unless the attorney is too cute for me, the application never again gets off my line and out to sea. The attorney is notified by a personal letter from me that he must file a supplementary amendment the character of which is indicated, to put the case in condition for allowance or final rejection, otherwise the amendment which has already been filed will be refused admission and the case when the year is up will be held abandoned

By this method the number of old applications has been greatly reduced. The exact extent of the reduction will not be known before the 1st of January, when another count will be made. We have kept track of the fifteen-year applications, and the count shows that on January 15th, 1914, there were 81; on June 30th, as above stated, there were only 52; and to-day, November 19th, 1914, there are 36.

The importance of getting rid of these old cases is very great. Mr. Oldfield, the chairman of the House Committee on Patents, and I are engaged in a friendly race; he to change the law, and I to change the facts so that his proposed legislation will not be deemed necessary.

I know the difficulties with which the attorneys have to struggle. I know how a busy office will suddenly become a cyclone center when some preliminary injunction motion or when necessity for the preparation of a court case makes it impossible to give attention to other matters. None the less I feel that it is the duty of the Bar to assist me, because the present law, giving to every applicant one year to reply after each action is in some cases a privilege which is almost vital. This is particularly true where an inventor is working with inadequate means and inadequate legal and engineering advice, and in the face of great difficulties is perhaps undertaking to develop some important and intricate invention, the exact lines of development of which are not clearly foreseen. The big concerns with ample capital and large force are not nearly so likely to be embarrassed by the changes in the law which Mr. Oldfield proposes. But in the interest of everyone practising before the Office, it is desirable that the liberality of the law be not impaired.

Reducing the Number of Interferences.

Interferences have been a great source of trouble to the examiners and to applicants. There are altogether too many of them. With each one of the forty-three primary examiners declaring interferences wherever thought necessary, and each examiner who declares an interference hearing all motions to dissolve it, so that an interference once started could only be dissolved by inducing the examiner to reverse himself, the burden upon the Office and upon the public has become one source of serious criticism of the patent system. There are only two law examiners to help with the work of the Commissioner. One of these for eleven months has been devoting his entire time to going over with the examiners all proposed interferences before they are started, with the result that 25 per cent of those proposed by the examiners have never been started. In order to effect this reduction, a practice has been tried, among other things, of not establishing interferences where the difference of dates of filing of the applications involved exceeds two years. A count has recently been made that shows that where the difference of filing dates exceeds one year, the junior party has won in only about 6 per cent of the cases. If a one-year difference were adopted, about twenty interferences a month would be avoided. As a rough method of avoiding a large amount of work without actual loss of the right to a party who desires to start an interference with his rival after one of the patents has been granted, it has attractions which I must frankly tell you I am not able to resist.

* Address before the Patent Bar Association, Chicago, November 19th, 1914.

[Division of Applications.

Then there is the vexed question of division of applications. There are about 7,000 requirements of division made in the Office every year, or one in every ten applications on the average. These were formerly reviewable by the Commissioner on petition, but the Supreme Court of the United States in the Steinmetz case held that the question involved is one of merits and must go to the Board on appeal. Few appeals are taken because, as a rule, it costs nearly as much to take an appeal as it does to file a divisional application. The Board while enforcing the rule, has been, however none the less quite liberal. It has permitted in proper cases the joinder of process and product, of machine and product, and in one case, of machine process and product, all in one application. It has however, held that distinct and separate inventions cannot be claimed in the same application, and under the rule respecting genus and species, has limited the applicant to claims on the genus and one of the species. Its conclusions are believed to be in accordance with such decisions as Sessions v Romadka, 21 F. R., and Gage v. Kellogg, 23 F. R.

The attorneys and the courts are not much inclined to recognize the difficulties with which the Office struggles in this matter. For example, in Benjamin Electric Company v. Dale Company, 158 F. R., Judge Lacombe commenting on a requirement of division whereby the applicant was obliged to take out four patents to cover the subject-matter of his original application said that the natural way would have been to let him claim the whole matter in one patent. The natural way, according to Judge Lacombe, was to ignore the fact that there are 1,100,000 patents and that the subject-matter of each application must be assigned to its proper class for examination before patenting and the patents issued must be properly classified so that they can be found hereafter in further searches. None the less I own that the subject is one respecting which the practice of the Office is troublesome and not uniform. If I can get another law examiner, I will publish the important opinions of the Board upon division and permit any attorney who objected to a requirement to bring the matter before a law examiner for discussion with the examiner who made the requirement. This, I believe, would reduce the difficulty to as narrow limits as are practicable, in view of the legitimate demand of the Office.

The Fitness of Examiners.

There is a general attitude of the profession toward the Patent Office which I think is unwarranted in fact and be regrettable because of its consequences. In an argument in the Third Circuit some years ago one of the counsel, a man of great eminence and of splendid qualities, undertaking to rebut the presumption which arose out of a certain action taken by the Office, in answer to a question by Judge Lanning, said that he accounted for the action in this way: "The Patent Office at that time—the examiners are small men as you of course know, they are not judges and not very good lawyers—thoughtlessly and carelessly assumed that the two arts were distinct."

Every examiner passes upon between 500 and 600 cases to one the judge doing an average amount in patents will pass upon. It is true that the examiners are a good deal younger men than the judges on the average, but Dr. Pond, who recently resigned, had been on the examining corps for forty years and a primary examiner for thirty-four years, and Dr. Wilkinson has just resigned as primary examiner to become first assistant, in order to be relieved of a part of his duties after fifty years of service on the corps.

We have recently been having papers prepared by the members of the examining corps and read at meetings held once a week. These papers are being printed by the corps. On the average, they are on a very high plane and some of them display remarkable acuteness and learning.

Respecting those questions which come within the range of the duties of the examiner, there is no such superiority of judgment as the Bar and the courts are disposed to assume for themselves. The Office, moreover, has one great advantage over the courts, in that it understands the subject-matter under discussion, which many a judge decides patent cases without ever understanding.

I think that this attitude toward the Office arises mainly out of the fact that attorneys begin by soliciting patents and grow with the patents into the work of the courts. There is of course another basis for it, namely, that the searches made cannot be as thorough in all of these cases as the searches made in those particular cases, less than 1 per cent, which afterwards are litigated.

The appropriation for salaries for assistant examiners amounts on an average to about $10 for each

(Concluded on page 497.)



The Delta reservoir dam. Capacity 2,750,000,000 cubic feet.

New York State Barge Canal

A Waterway Rivaling in Some Respects the Panama Canal

By Ray Francis Yates

JOHN A. BENSEL, State Engineer, announces with assurance that the new barge canal will be open for navigation in 1915, a statement of great concern to the people and welfare of New York State. The new waterway is the greatest canal-improving project ever attempted and one of the greatest undertakings ever started in the history of the world. Much credit is due to Engineer Bensel, who, as a guiding spirit for this great problem, has shown unusual ability and engineering instinct that places him foremost among our most eminent engineering workers of the day.

In some ways the new barge canal as an engineering work rivals that at Panama. A total of forty dams have been built, rivers have been canalized, numerous locks have been constructed, 248,056,800 cubic yards of earth have been removed. To this is added 6,137,100 cubic yards of excavation necessary for the erection of dams, locks and other structures that are connected with this great waterway. To defray the expense of the new canal and the fifty terminals that are to be constructed along its course, the State of New York appropriated $128,000,000. While this figure of expense is far below that required for the Panama canal, it must be remembered that the barge canal is being constructed in a temperate zone, where labor and working conditions are not so severe as those on the Isthmus.

For a distance equivalent to more than one half its length the new canal passes through natural streams which have been converted into canalized rivers. In reality the barge canal is an elaborate system of waterways, the most important one being that which replaces the Erie canal. The branches, three in number, are the Champlain, the Oswego, and the Cayuga and Seneca. The Champlain canal connects the eastern terminus of the main canal with the head of Lake Champlain. The Oswego canal branches off the main canal at a midway point and runs due north into Lake Ontario. The Cayuga and Seneca connects the main canal with both Cayuga and Seneca lakes. Including the branches, there is 790 miles of navigable waterways, constituting the new canal system. Of this figure 440 miles has been constructed and the remaining 350 miles lies through canalized streams. To tame the Mohawk River to navigation alone necessitated the construction of ten dams.

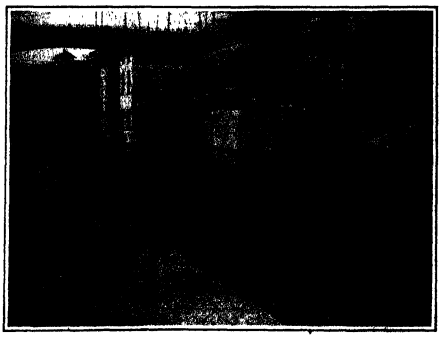
In the construction of the barge canal system, the old Erie canal was widened to 75 feet and deepened from 9 to 12 feet. These figures are standard on all branches of the system. The most important streams and lakes utilized are: the Mohawk and Clyde rivers, Wood Creek, and Cayuga and Seneca lakes.

The canal has two summit levels. One is situated near Rome, and the other at the western terminus. An adequate supply of water for the western summit level was secured by tapping the Niagara River. The problem of obtaining a sufficient supply at the Rome summit level was, however, a more difficult problem and necessitated the erection of two large reservoirs. One of the reservoirs, the Delta, located on the site of the former village of Delta, which was removed to permit of its construction, has a capacity of 2,750,000,000 cubic feet of water, and was erected to impound the waters of the Mohawk River. The wall forming this great reservoir is 1,100 feet in length, 300 feet of this being used for a spillway. Exactly 90,000 cubic yards of concrete was used in the construction of the wall. The water supply of this reservoir is obtained from the natural drainage of 137 miles of land.

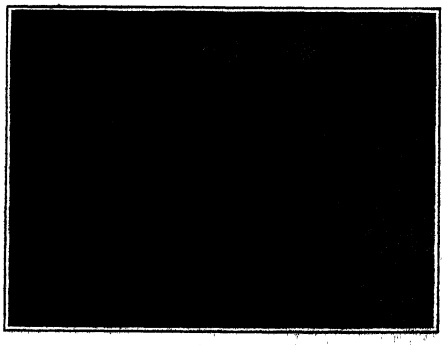
Another great reservoir which forms a feature of the canal system is built across West Canada Creek at the village of Hinckley. While the concrete work on this reservoir is not as elaborate as that on the Delta, it has a far greater capacity and is equally important. The wall here is 3,700 feet long and capable of retaining 3,445,000,000 cubic feet of water. It is formed with a wall of concrete which is reinforced with earthen embankment. The masonry on the wall totals 721,200 cubic yards. Both the Delta and Hinckley reservoirs lie in the slopes of the Adirondacks and receive their entire water supply from the precipitation of this region.

There are also many movable dams of the bridge type on the canal, and, where local conditions permit, dams known as the Taintor type have been constructed. Near the village of Herkimer on the Mohawk River a dam of the Poiree type has been erected. This dam is the first of its kind to be built in America. It is technically known as the "hook-needle" dam, and is formed by suspending a series of timbers or "needles" across the stream in such a way that their position, which is adjustable, controls the amount of water flow.

The barge canal is equipped with a total of fifty-seven locks, thirty-five of this number being along the Erie branch. Near its eastern terminus, the canal has five of the greatest lift locks in the world. It is here where a boat is lifted 169 feet within a mile and a half distance. Lock No. 17, at Little Falls, bears the dis-



Old and new locks at Lockport. Hydro-electric station in the foreground.



A lock chamber with a lift of twenty-four and one half feet.

tinction of being the greatest lift lock in the world. It is capable of lifting a barge 45½ feet. This is also the only lock on the canal utilizing a lift gate.

The only siphon lock in this country has been constructed on the Oswego branch of the canal system at the city of Oswego. This lock is the largest in the world employing the siphon principle. The culverts are formed in a swan-neck manner, and are above the water level much the same as a hose is placed when used for a siphon. All air is excluded except that which is admitted through the operating pipes. The flow of water is established in the siphons by rushing water through them from supply tanks nearby. The lock chamber may be filled in 5 minutes and emptied in 6 minutes by this method, the entire operation being controlled by the manipulation of 4-inch air valves.

With very few exceptions, all the locks on the new canal are identical in general construction and a description of one set will suffice for all. The locks at the city of Lockport are very interesting, and will be described as an example. There is only one other location on the canal where it was found necessary to place two locks immediately adjacent to one another, as is the case at Lockport. This occurred at Seneca Falls. Before the new locks were constructed at Lockport the drop of 49 feet was accomplished with five locks of the old type. There were two of such columns, and one column was completely obliterated to make room for the new locks. So rigid were the great stones of the old lock placed that in many cases very severe charges of dynamite had to be used to dislodge them.

The new locks, in which 62,000 cubic yards of masonry were used, measure 45 feet in width, 46 feet in depth and 311 feet between gates, being capable of accommodating a 3,000-ton barge 300 feet in length. This capacity is approximately six times the capacity of the old locks, which were only 100 feet long and 18 feet wide. In the construction of locks throughout the canal, where a rocky bed existed an artificial bottom was not constructed. Otherwise a concrete floor was installed which was underlaid with piles driven into the ground.

The locks are electrically operated in every detail, reducing the human effort in locking a boat to a minimum. The gates, which are of the girder type and weigh 47¼ tons each, are driven by 7½ horsepower General Electric direct current motors by means of a rack and pinion system. The extreme motion of the gates automatically opens the motor circuit by the operation of a limit switch. The gates may be opened in one minute. Means are also provided to open the gates by human force in the event of the electrical equipment becoming disabled.

The valves, which weigh 7½ tons each, are also operated by motors of the same type as those used on the gates. The valve consists of a large slide which passes over the mouth of the culvert. The slides are suspended on chains with suitable counterweights. The chain wheels, which are connected to the motor through a train of gears, pull the slide at the rate of 6 feet per minute. The valves are also equipped with limit switches and means of control in case of mishap.

Electrically driven capstans are provided for each lock, which are capable of moving a boat 60 feet per minute. These are driven by a 20 horse-power direct current motor.

A master controller is located at the side of each lock, and one man may lock a boat through without moving from his position. A clever system of signal lights indicate the different positions of both gates and valves when they are being opened or closed.

The power used to operate the electrical equipment of the locks is generated by the head of water available at the top of the drop.

Outside of the numerous locks, dams, and reservoirs that have been constructed, 400 other structures have been built. These include guard-gates, spillways, breakwaters, docks, and aqueducts.

The canal, when completed, will have fifty terminals located at different cities and towns situated along its course. The terminals will be thoroughly equipped for both the shelter and handling of freight. Every terminal will be owned and operated by New York State, and by no means will any private concern be allowed to construct or maintain a terminal.

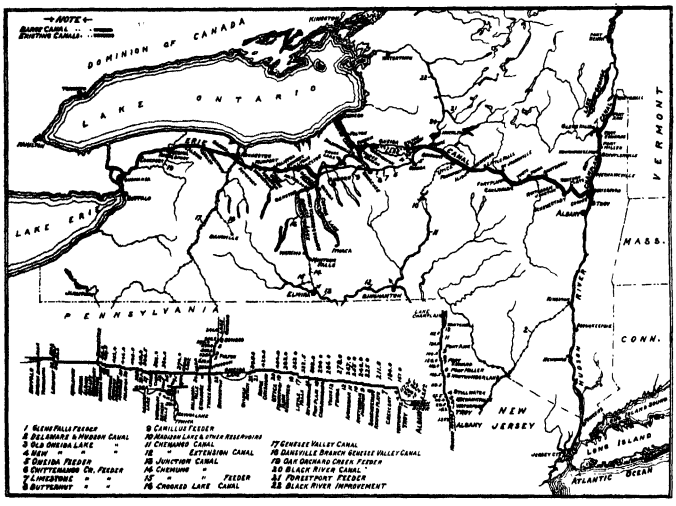
Approximately 1,200 cubic feet of water flows into the canal per second, which will permit of 10,000,000 tons seasonal traffic. This figure may be increased to 20,000,000 tons without overloading the canal.

Just what design of boats will be used on the new canal cannot at present be definitely ascertained. It is prophesied, however, that the barges will either operate by gasoline or electricity. It is rumored that already there is a company organized and contracts let for the construction of thirty electrically propelled barges. Many think that one power-carrying boat pulling three others would be a practical arrangement.

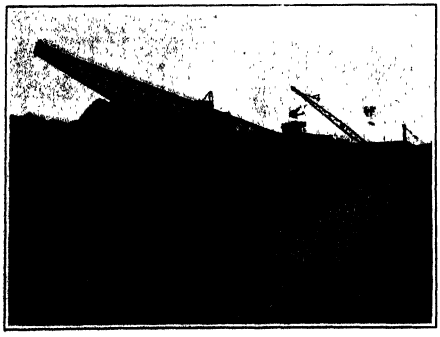
It is an astonishing but true fact that, including Lake Erie and Lake Ontario, 73½ per cent of the total population of New York State is within two miles of the canal. It is anticipated that with the opening of the canal the commercial application of the motor truck will be greatly broadened in the State as some means of transportation will be needed to carry freight from the terminals to adjacent cities and towns.



A battery of channelers at work on the canal.



Map and profiles of the New York State barge canal.



A tipple incline conveyor excavating machine at work on the canal.

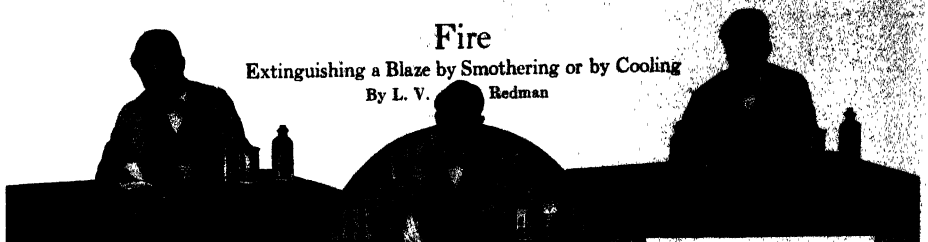
Production of Radium in Europe

ACCORDING to a writer in *Radium*, the Austrian government—the largest European producer of radium—obtained 2,014 milligrammes of radium element in the salts produced in 1911 and 1,498 milligrammes of radium element in 1913. The data on production in 1913 is not yet available so far as the writer is aware, and while strenuous efforts were being made to increase the output in 1913 and 1914, it is doubtful whether more radium will be obtained than in preceding years. The Austrian radium is produced from the Joachimsthal pitchblende. Other European producers use Cornish pitchblende, and Portuguese autunite. Considerable Colorado carnonitite was shipped abroad in 1912 and 1913.

Fire

Extinguishing a Blaze by Smothering or by Cooling

By L. V. Redman



Smothering a gasoline blaze.

Pouring carbon tetrachloride on burning alcohol.

The flame nearly severed.

WHAT is the right thing to do at the right time to prevent heavy losses by fire?

The putting out of a fire depends upon bringing into operation either of two conditions: All air should be excluded and the fire will die out for want of oxygen; or the burning materials should be cooled below the point of ignition.

Such ready to hand methods as throwing a blanket or coat tightly over a burning object to exclude the air, placing a lid on a pan or pot of flaming grease, or covering a burning object with a fine non-combustible powder, viz., washing soda, fine sand, clay, etc., will in general put out the fire.

Burning gasoline, as shown in one of the photographs, is being extinguished by the operator sliding a flat glass plate over the vessel, thus excluding the air. The flame is severed from the gasoline as if it were cut off by a knife. Another picture shows the operation almost completed. The popular and altogether false idea that such liquids as kerosene, gasoline, alcohol, benzol, etc., are in themselves explosive, and will burn in the absence of air is erroneous, and it should never be forgotten that these liquids cease to burn when the air is cut off. The cover should always be made to slide along horizontally, for if it be dashed down on the flame from above, the rush of air will cause the flame to burst out in all directions around the plate toward the operator as well as away from him, and may set fire to the clothing or hair.

The second principle, i. e., the chilling of the burning materials to a temperature below the point of ignition is brought into effect when cold sand, clay, snow, or water is thrown upon a burning surface, or when a rapid current of air removes the heat more rapidly than the combustion is producing the same. There is a temperature for every substance below which it will not burn, e. g., if wood be chilled below 155 deg. Cent., i. e., 311 deg. Fahr., it will not readily burn.

Everyone is familiar with the blowing out of matches by the wind, which cools the match below the point of ignition. Fire rangers put out spreading grass fires in this way, by beating the burning grass into the colder earth and chilling the stubble below the burning point.

Nor will iron burn if kept below a red or even white heat. To be sure, everything burns, i. e., oxidizes at almost any temperature. Wood weathers and decays at ordinary temperatures and iron rusts and oxidizes in the cold air of winter, but very slowly, so that we do not ordinarily consider or think of it as burning. The word burning or combustion is used here in the popular sense of being oxidized at such a rate that the chemical reaction is accompanied by a flame or a visible glowing surface.

In most fire extinguishers, either or both of these principles are involved. When water is thrown upon a fire to put it out, the result is plainly to cool the burning materials below the point of ignition, although when the material is flooded with water, the air is also excluded.

When a fire extinguisher, like soda, is thrown upon a burning surface, the result is more or less twofold. The cold powder helps to chill the flaming material below the point of ignition, and at the same time excludes the air by two means: first, by giving off carbon dioxide, and, second, by covering the burning surface with a non-inflammable material.

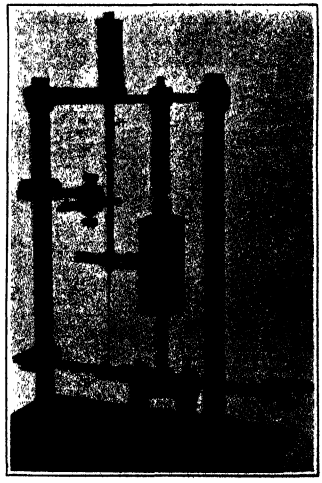
In recent years, quantities of chlorinated hydrocarbons have been prepared from the waste chlorine in the manufacture of caustic soda. The lower hydrocarbons saturated with chlorine are fire extinguishers of a very valuable type, and are sold under many trade names. Carbon tetrachloride is the lowest and the most common of the series. It is also sold as a non-inflammable liquid to take the place of gasoline, benzol, alcohol, for removing grease stains from clothes.

The special value of carbon tetrachloride consists in its non-corrosive properties, e. g., it may be poured into a burning motor without doing the motor any after damage, such as rusting, and the fire is immediately extinguished. In this respect, it is superior to water, as a fire extinguisher. However, tetrachloride is of little value in extinguishing flames from vessels containing burning alcohol, acetone or other liquids with which the carbon tetrachloride does not mix readily.

The operator in one of the photographs is shown pouring carbon tetrachloride from a glass cylinder upon a dishful of burning alcohol. The tetrachloride has no effect whatsoever in stopping the flame, nor does it put out the fire if it is sprayed into the burning alcohol. Fires of this kind can be best smothered out as shown in the pictures at each side by cutting off the air.

It has not occurred to the reader, perhaps, that sometimes it may be positively dangerous to throw water on a flaming material. Yet such is the actual condition. For example, if liquid paraffin be on fire, the addition of water may cause an action similar to an explosion. The hot paraffin floats upon the water and prevents the escape of the steam, until suddenly the steam escapes with an explosive rush carrying the flaming paraffin in a burst of blaze which almost fills the room, and the burning proceeds more violently than before. The same phenomena is noticed with all burning oils and easily combustible liquid organic substances, which float on water. Burning benzol, benzine, naphtha, gasoline, kerosene, acetone, etc., all burn in the same way, so that for these fires, water may not be used; but sand is one of the best known extinguishers. Cold sand thrown on the burning material chills it below the ignition point, and the fire is put out.

A barrel of fine sand standing in a readily accessible place is a most valuable fire extinguisher to possess. If the sand is fine and clean, it is easily scattered over the burning surface and chills the surface below the point of ignition as well as excluding the air. The sand is easily swept up and removed after the fire has been put out, and everything that has not been damaged by the fire remains in perfect condition.



Machine for testing watch springs.

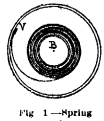


Fig. 1.—Spring wound-up



Fig. 2.—Spring unwound.

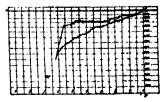


Fig. 3.—Spring of good quality after 6 year run.

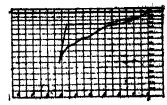


Fig. 4.—Same as in Fig. 3, after cleaning.

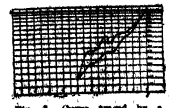


Fig. 5.—Curve traced by a watch spring of poor quality.

Diagrams made by the testing apparatus. The upper curve shows winding and the lower unwinding.

Watch Spring Testing Apparatus

By the Paris Correspondent of the Scientific American

A SIMPLE and accurate device for testing watch springs is the invention of M. Charles Poncet, chief of the national watch-making school at Cluses, in the region of Geneva. In this way it is possible to observe the value of a spring as shown by its regular working, by means of a curve inscribed on a chart. It is well known that in the usual spring barrel of a watch, the spring is wound up close around the center shaft by a watch-key or otherwise, then the spring, one end of which is fastened to the barrel, begins to unwind slowly, causing the barrel to revolve. When all unwound, the coils of the spring now lie around the inside of the barrel and the shaft is free. Between these two positions, the spring has a variable tension, but by the use of good quality springs, the tension can be made more regular, which is desired for the good working of the timepiece. With the new instrument it can be seen at a glance just how the spring is working at any time, and whether its force is regular or not.

Our photograph shows the appearance of the new watch spring testing apparatus, and the whole is mounted upon a flat base, the framework being made up of two stout columns and an upper cross-bar. At the lower part is mounted a small shaft and a crank, so as to carry the spring-barrel *B*. The object of the device is to wind up the spring inside of the barrel by means of the crank, and at the same time to cause the barrel, which as we have seen in connection with the spring, to exert a pull by means of a cord and rod, upon an upper spring which is seen at *H*, and by this means to inscribe curves upon a drum. To this end, the barrel can be readily fitted upon the lefthand end of the shaft, and the righthand end then adapts itself to the square end of the spring shaft so as to be able to wind up the spring just as a watch key would, and the winding is thus carried out by turning the crank. The spring shaft is connected to the barrel only through the spring itself, which thus couples shaft and barrel by a loose and not by a fixed coupling, so that it is ex-

(Concluded on page 507.)

Fasciated Sunflower Stems

The accompanying photograph represents a specimen of the common black-eyed Susan, in which three flowers, with their stems, appear to have grown together as one. The specimen was found by Louis Van Raalte of Schenectady, New York. Inquiry at the Department of Agriculture has elicited the following information in regard to this freak:

"It is an example of what botanists call fasciation. The Latin word *fascia* means a broad band, and a fasciation is a stem which has become expanded into a flat ribbon-like form as if several stems had grown together in one plane. Perhaps no plant, unless possibly the daudelion, is oftener found in a fasciated condition than the black-eyed Susan. Seedlings of *Ailanthus*, the Chinese tree of heaven, are frequently found with the main stem expanded into a fan-like fasciation several inches wide.

"Some fasciations are due to mechanical injury, but most plants which show the peculiarity have inherited it, and are in turn able to transmit it to at least part of their descendants. The common red cockscomb of gardens (Celosia) is an example of a plant in which the fasciated condition is more familiar than the normal. It is of course reproduced from seed. Oftentimes the tendency to develop fasciated branches is inherited, but the character does not become manifest for several years, or not until conditions become especially favorable. At least one case has been recorded in which an apparently normal plant of the black-eyed Susan was transplanted to a garden, and thereafter, until it died, developed fasciations and various other abnormalities each year. The corn plant frequently bears fasciated ears. Probably many of your readers have observed such ears of popcorn. Both normal and fasciated ears may be borne on the same plant, and seeds from either a normal or fasciated ear of such a plant may give fasciated ears in the next generation. In fact, there is a cultivated variety of sweet corn known as bear's foot, which normally has fasciated ears."





An example of fasciation. Three black-eyed Susans grown together.

Stepless Omnibuses in New York

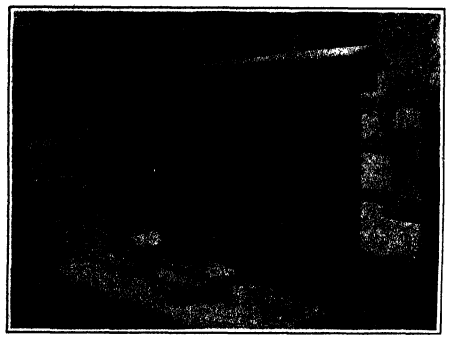
FOLLOWING in the wake of the "stepless" trolley cars in use on several street car lines in New York city, the first "stepless" motorbus has made its appearance in America's largest city. The vehicle is electrically driven, and presents a somewhat novel appearance to those familiar with the usual type of motorbuses.

The height of the "platform" above street level is but 12½ inches, or an easy step even for hobble-skirted feet. The vehicle is double-decked, the stairs being inside, toward the rear. It has a seating capacity of eighteen persons inside and twenty on the "hurricane deck." The roof of the omnibus is but 7 feet 8 inches above street level, which insures its safe passage under all elevated railroads and trolley wires. This, in a city like Brooklyn, for instance, is of the greatest importance.

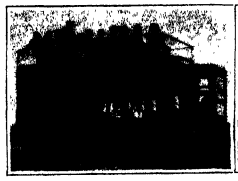
The driver's compartment is glass-inclosed and is reached from the inside of the vehicle. The total length of the omnibus is 20 feet 10 inches. Power is furnished by a hundred-cell Edison storage battery to two 10 horse-power motors, which transmit motion to the rear wheels by means of a universal shaft, without differential. The vehicle can be operated at a speed of 20 miles an hour, if desired.

An Equine Electric Generator

AN inventive genius in Cincinnati has invented a "one horse-power" electric generator in which the prime mover is a real horse. The apparatus is in the form of a mill, with a 14-foot track, around which the horse has to travel, thus imparting motion to a set of gears connected to a dynamo. To keep the horse moving, he has devised an automatic whip, which may be seen in the accompanying photograph. As long as the horse is moving this whip is inoperative, but as soon as the tension on the traces is relaxed a circuit is closed which energizes a solenoid. This gives a tug upon the core of the solenoid, which is connected by a cord to the butt-end of the whip. The result is a light tap on the back of the horse, which reminds him that he must keep moving. At the same time an electric bell is sounded, which calls the attention of the owner to the fact that the horse has stopped, and if he finds, by hearing the continuous ranging of the bell, that the horse has not obeyed the whip, he can go out to use further methods of persuasion. The electricity generated by this apparatus goes into a storage battery. It is claimed that three hours' work furnishes enough current to light the house for an entire week.



Iron hulled German submarine built in 1850, now on exhibition at the Naval Museum in Berlin.



The stepless omnibus in New York.



Individual wire windshield.



A "one horse-power" electric generator, which furnishes light for a seven-room house.

The First German Submarine

AMONG the historical relics on exhibition in Berlin is the "Pioneer Marine," Germany's earliest submarine. It was invented by a Bavarian named Wilhelm Bauer. The boat is of iron and dates back to 1850. It was tried at Kiel, but its thin sides were crushed by the pressure of the water, and it remained at the bottom until it was discovered when the first excavations for the Kiel Canal were being made. The old submarine was then raised, and placed in the Naval Museum in Berlin. Old as it is, this submarine is not the first one ever built. References to submarine operations date back to 1372. In 1727 no less than fourteen submarine patents had been issued in England. In 1775 H. M. S. "Eagle" was attacked in New York harbor by a submarine built by David Bushnell. Sergeant Lee, in charge of the submarine, actually got under the ship, but was unsuccessful in attaching the torpedo to the bottom of the vessel. Between 1795 and 1812 Fulton experimented in France and America, and showed that it was possible to build a vessel which could be navigated under water.

Wire Windshields

PICTURED in the accompanying engraving is a small windshield of wire netting mounted on suitable brackets directly in front of the steering wheel of an automobile. It is just large enough to screen the driver of the machine and is of particular value on a high speed car as it offers far less resistance than the ordinary glass windshield which stretches across the entire width of the car body. Being made of wire netting it never bothers the driver with the glare of reflected light. Although porous, the air cannot pass through it with sufficient velocity to produce an objectionable draft. Furthermore, in case of accident the driver need have no fear of splinters.

Ecological Evidence in Court

A NOTE in *School Science and Mathematics* records what is said to be probably "the first recognition of ecological methods in courts of law," the case being one in which Prof. Henry Chandler Cowles of the University of Chicago was engaged by the United States Department of Justice to decide from the nature of the timber and other evidence whether a certain tract of valuable timber land in Arkansas had been a lake at the time the land was surveyed in 1847. Prof. Cowles's investigations proved that the survey which showed this region as a lake was undoubtedly fraudulent. Not only was there no evidence of a beach line, but many immense upland trees were found on the tract, ranging from 200 to 1,000 years old. In the same connection Prof. Cowles also investigated certain other tracts which had been surveyed as lakes, with similar results.

SEVENTEENTH ANNUAL

Motor Number

of the

SCIENTIFIC AMERICAN

January 2, 1915

FOR a complete history of the automobile refer to the files of the Scientific American. The whole story is there from the birth of the motor-driven vehicle, long before the first automobile journal was published, down to the present day. Week by week the biography is written and annually there is a *resumé* of the year's developments. The seventeenth annual *resumé* will be found in the issue of January 2, 1915. The following are some of the subjects that will be taken up:

The Car of 1915. One might suppose that in all these years of development the automobile had reached a point where there would be practically no further growth. However, the new year ushers in some important innovations and a great many lesser improvements, which, slight as they may seem, make for greater comfort and convenience. They will be described fully and illustrated with sketches.

American Auto Coach Work. Foreign car-body builders, instead of following standard patterns, have shown a great deal of originality in the design of car bodies. This is now having its effect on on our own car-body builders who are coming out this year with many artistically modeled vehicle bodies. There will be a discussion of this subject with pointed criticisms of various models both foreign and American. The article will be illustrated with a score of automobile body designs.

How Small Communities May Have Good Roads. Never in the world's history have roads been subjected to such hard usage as in the present day, and never has the subject of road-building received so much scientific investigation. Yet out of two and a quarter million miles of public roads in this country, only a quarter of a million are improved with any form of surfacing. Evidently there is still a great deal of work to be done by rural communities. Logan Waller Page, Director of the Office of Public Roads, gives some valuable suggestions on co-operative undertakings that will make good roads available for small communities.

Military Tactics and the Motor. The absolute necessity of the motor car in modern warfare has been demonstrated in the present titanic struggle in Europe. A very comprehensive article has been prepared on the use of the motor vehicle, in transporting guns, ammunition, supplies and men, and in bearing the wounded to the rear.

The Fuel Problem. The enormous demands upon our supplies of hydrocarbon fuels have made it necessary to develop new methods of obtaining fuels volatile enough to be used in the motor car. The Burton process of producing gasoline has done much to relieve the shortage. Just what this process is will be explained in full.

Purchaser's Guide. As in previous issues of the Annual Motor Number there will be a table of American made cars classified according to price, so that the prospective purchaser may know what he can buy for $500, $1,000, $1,500, etc. There will be a similar list of commercial vehicles classified according to capacity.

In addition to these articles the issue will contain illustrations and brief descriptions of the latest automobile accessories. There will be an oiling chart for the automobile, explaining what parts need attention in the standard chassis and engine. A motorcycle trouble chart will explain where troubles are liable to occur and how they may be overcome or avoided.

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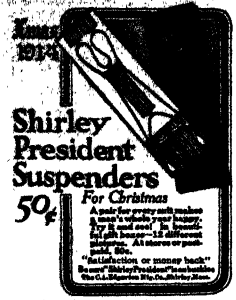
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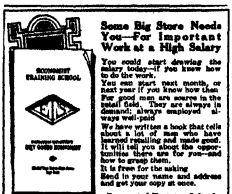
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Watch Spring Testing Apparatus

(Concluded from page 494.)

dent that when the barrel follows the movement of the spring shaft it will rotate, but the force produced by its rotation depends on the condition of the spring which couples the shaft to the barrel. Were the shaft coupled direct to the barrel the pull exerted by the latter through the cord and on the top spring would be quite uniform, and the pointer which is attached to the cord and strip would move in a straight line. But as the force of the crank and shaft is transmitted to the recording part through the action of the spring, it is evident that the elasticity of the spring enters in as a factor in the amount of pull which the barrel now gives upon the recording part of the apparatus, and should the elasticity be variable, the pull will also be variable.

The barrel is connected to the rod or strip by means of a silk thread, or in the case of stronger springs, such as clock springs, by catgut cord. A guide piece attached to the pillar serves to keep the vertical movement quite straight. In order to secure the records, the cylinder *C*, which carries the ruled paper, is made to rotate at the same time that the shaft is being turned, and it is connected with this shaft through the worm gear, which will be observed. On placing the mounting barrel with its spring, the crank is slowly turned so as to stretch the silk thread, and this serves to set the apparatus for the start. It only remains to loosen the recording drum by means of a set-screw and to adjust it so that the pen will be placed at the zero point on the paper, after which the drum is again affixed to its shaft. The actual test upon the spring now begins by winding it up slowly with the crank, and the variable pull given by the spring is recorded. This is continued until the spring is wound up. By unwinding, a reverse curve can be had, with some difference due to friction. One chart shows a good watch spring which had been in use for six years, and the second chart represents the diagram of the same spring after cleaning. It is remarkably regular at the point between 2½ and 5½ turns of the crank, and can be compared to chart 3, made with an inferior spring. The value of the new apparatus for checking up the quality of watch or chronometer springs is thus evident.

The Work and Needs of the United States Patent Office

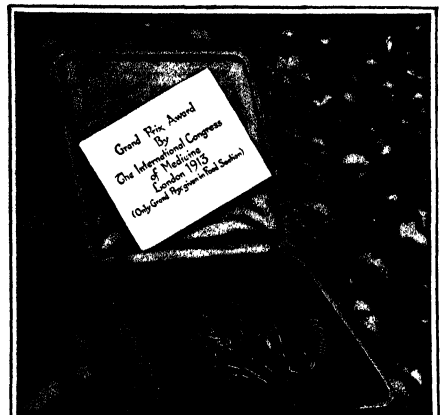
(Concluded from page 491)

application filed, which means that each assistant may devote to one applicant ten hours' time. I am fully convinced that it would pay the public in the greater certainty respecting patents, reduced trouble in the courts, and complications in business and the like, if the Government were to appropriate at least twice as much as is now appropriated, without respect to the fees received by the Office I have never urged the surplus as a reason for larger appropriations. If the work were being adequately done, the fact that there is a surplus might be ground for reducing the fees, or perhaps for increasing salaries paid, but not for enlarging the force. Moreover, an enlargement of the force to the limit of the surplus would not make adequate provisions for proper searches.

But whatever Congress may do, even under the most favorable conditions, it will still remain true that parties contemplating litigation would spend on the average more time and money than can be spent on all applications filed. The courts will always have more light on the particular cases brought into litigation than the Patent Office has on those applications when they go through the Office. The Office will, therefore, always be open to the charge of doing superficial work which of course impairs the respect for it.

Growth of Work in the Patent Office.

Conditions in this respect are growing worse rather than better. The committees of Congress have adopted a sort of a rough rule that they will grant increases only on the basis of increase of number of items of any class to be dealt with. If, for example, one man can handle say



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2,000 places of color a day until the number is 15, places of until is drafting, that will grant appropriation for another year. The application of such a rule at the Patent Office is unfortunate for three reasons: first, that the work has always turned the capacity of the force provided, and therefore increase in the number of examiners in proportion to the number of applications filed leaves the force inadequate; and secondly, that the field of search is widening so that the labor of handling a single application increases with time. For example, in 1884 there were, roughly, 300,000 United States patents. In 1904 there were, roughly, 500,000. In 1914 there were, roughly, 750,000. Now, in 1914, there are over 1,100,000. Proper classification may do much to lighten the labor of searching, but nothing can prevent embarrassing growth in the number of patents which must be searched through against each application. The foreign art which is available is increasing, moreover, in even larger proportions.

Nor is there any hope that the number of applications will diminish, and the Office force thereby becomes adequate for handling the current business. Even in the present disturbed state of the world's business, more applications are being filed this year than last, and since 1884 the number of applications filed per year has grown from about 35,000 to about 70,000.

I believe that this growth will continue. The reason will be plain on a moment's consideration of the nature of the invention. I shall not undertake to give a formal definition of a patentable invention under our law, but it is essentially a new relation of utility in an art, machine, manufacture, or composition of matter. The more arts, machines, manufactures, and compositions of matter that there are, the more relations there are that may be discovered. I have no doubt that in another twenty-five or thirty years the number of applications filed per year will reach 100,000.

If Congress cannot be educated to an understanding of the difficulties which these conditions present, the system of examination will break down of its own weight. I trust that you gentlemen of the Bar may be able to help in this work of education.

The Current Supplement

A MOST interesting article in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT No 2082, for December 12th, describes a series of ingenious experiments for ascertaining the effect that water pressure has had in determining the form of different classes of fish. Another valuable article is a continuation of the investigations into the acoustics of auditoriums, made at the University of Illinois, and the methods adopted for remedying certain defects. The article by Dr. Dudley on rail sections is completed. Some facts in regard to the sources and supply of Spanish cedar are given, with illustrations. Ideals in city planning contains suggestions in regard to results to be sought, that can be secured by business administration by trained experts. There is also a story about some of the new Government Workshops in Washington. Other articles describe an instrument that enables the blind to read by sound; a prismatic astrolabe for determining time and latitude; theories about the Gulf Stream, and identifying different types of electric motors.

Extending the Term in Applications for Design Patents.—In carrying out the practice instituted by Commissioner Ewing, of permitting an applicant for a design patent who specified the term in his application as two and one half years or seven years, to extend such term after the filing of the application on the payment of the additional fee, the Patent Office when a design application for one of the shorter term, is found to be in condition for allowance, addresses a letter to such effect to the applicant or his attorney suggesting that the term may be extended within the maximum period allowed by law together with the balance of fee for the larger term and allowing a certain time specified within which such action may be taken.

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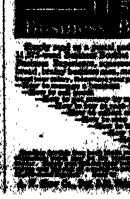
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The METROPOLITAN for 1915 will contain the biggest and most costly editorial features ever announced by any magazine. Here are some of the good things you will enjoy: A new serial novel by HENRY SYDNOR HARRISON, who wrote "Queed" and "V.V.'s Eyes." "The Story of a Pioneer," which is the autobiography of DR. ANNA HOWARD SHAW. All of the short stories of RICHARD HARDING DAVIS, JOSEPH CONRAD, W. W. JACOBS, and more short stories by RUDYARD KIPLING than will appear in any other magazine. A new series of humorous and tender Irish stories by RUPERT HUGHES. A new boy series, more enjoyable than his "Penrod" stories, by BOOTH TARKINGTON. JOHN REED'S vivid word-pictures of the great war. Other contributions by LARRY EVANS, GEORGE BERNARD SHAW, INEZ HAYNES GILLMORE, FANNIE HURST, ARNOLD BENNETT, WILL PAYNE, F. TENNYSON JESSE, CONINGSBY DAWSON, HENRY KITCHELL WEBSTER, A. E. W. MASON, LEROY SCOTT, W. B. MAXWELL.



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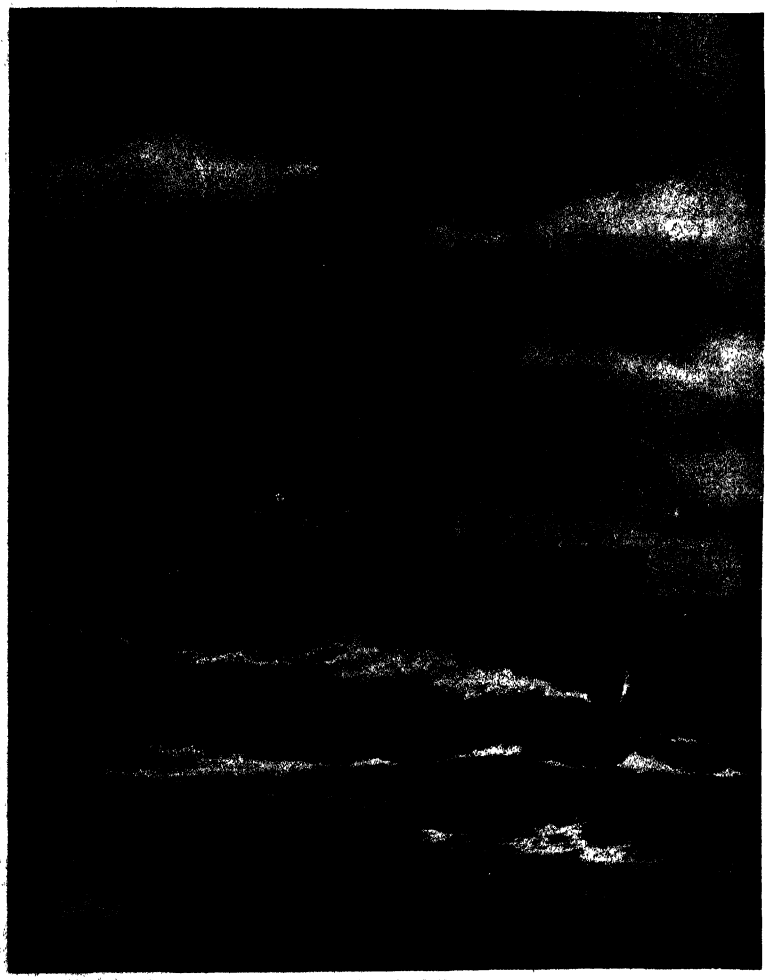
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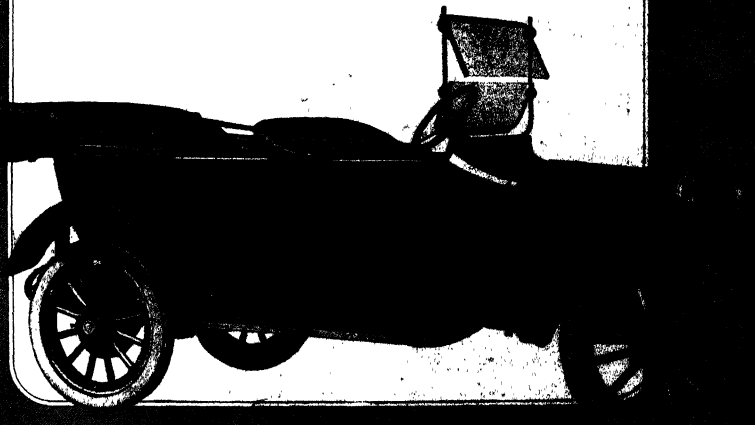
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Further Experiments on Life Without Microbes

By Jacques Boyer

IN the SCIENTIFIC AMERICAN for April 13th, 1912, page 368, there appeared a description of the apparatus and the methods used by Dr. Cohendy in the course of experiments which he made in an attempt to answer the question whether higher animals could live without the presence of microbes in the alimentary canal. Dr. Cohendy had hatched out many chicks in his apparatus, which permitted the indefinite maintenance of a controlled temperature, air, food, etc., in absolutely aseptic conditions. The chicks thrived for several weeks and were in every way equal to those raised under similar conditions, but exposed to invasion by microbes. As a final check on the sterility of the apparatus, food, etc., some of the chicks in the apparatus were killed by allowing fumes of chloroform to enter with the air, and then bits of their feet, feathers, beaks, guts, etc., were placed in sterile culture tubes, such as are used in bacteriological studies. These always failed to show bacterial growths.

In later experiments, some of the chicks raised in these sterile surroundings were exposed before being killed, with the purpose of finding out whether the absence of bacteria in the alimentary tract has any effect upon the immunity of the animals toward disease germs. These animals resisted the artificial infection as well as ordinary chicks, showing that the immunity is not acquired by the early conflict with bacteria, but is a constitutional, hereditary trait.

The question whether other animals could thrive as well as did the chicks when deprived of the bacterial inhabitants was answered in the affirmative in a recent communication to the Paris Academy of Sciences. Dr. Cohendy, assisted by Dr. Eugene Wollmann, showed by means of later experiments with guinea pigs that the ability of animals to live without microbes is general.

In this experiment the young mammals were removed from the uterus by the Cesarian operation, as closely as possible to the time of normal delivery, and placed in the incubators used in the work with the chicks. In this incubator there had been placed thoroughly sterilized food, consisting of hay, alfalfa, bran and milk, the latter supplied through a tube connected in a way that permitted the delivery of desired quantities without danger of contamination by microbes.

As a means of control, young cavies taken from the mother at the same time were kept in identical conditions, with the exception that they were not guarded against bacterial infection. Nine groups of guinea pigs were used, four of them being kept perfectly sterile for periods varying from sixteen to twenty-nine days. As a final check on the actual sterility of the animals and their environment, bits of the contents were removed from the incubator and from the intestines of the animals and placed in culture tubes.

The increase in weight on the part of the sterile guinea pigs varied from 9 to 33.5 per cent, whereas the "normal" animals gained from 87 to 24 per cent. At the same time the chemical examination of the excrements showed no appreciable difference between the two groups of animals.

These experiments confirm those made by Nuttall and Thierfelder, showing that cavies can be raised without the presence of bacteria, and agree with Kuster's similar experiments with kids. It is probably safe to conclude that this is, in general, true of all mammals.

Drs. Cohendy and Wollmann are planning to carry these experiments further, in the hope of determining the action of various species of bacteria in the digestive tube, and of analyzing the process by which bacteria in the intestines lead to disease or to poisonings of the organism.

Namur Stadium

A FINE specimen of concrete construction is the new stadium at Namur, in Belgium, which was laid out on the summit of the citadel, where it enjoyed a wide view. The grounds laid out for the games are about 1,000 feet long and 500 feet wide, and the stadium lies at one end of the grounds and consists of a series of reinforced concrete steps for seats, of 360 feet length. In the rear is a loggia construction with columns, which have tribunes on one side, while the other side serves for the scene of an open air theater. In the middle of the loggia is the royal box. A good part of the structure is built on the Hennebique reinforced concrete system, and other parts in concrete or in stone.



These guinea pigs are living in sterilized air, an experiment made to ascertain whether or not microbes are essential to life.

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The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Hysteria and Common Sense

THERE is too much hysteria and too little common sense in the present discussion of the question of our national defense. Between the man who would have universal conscription and make of every able-bodied citizen a soldier, and our Secretary of State, who affirms that he can raise an army of a million over night (and arm them, presumably, with scythes and pitchforks) stands the great body of the American people, which demands that, if we are to have an army and a navy, they shall be adequate for policing our coastline and frontiers, and sufficient for the defense of the people, the property and the great national principles and policies of the United States of America.

The trouble with the extremists in this discussion, both the peace and instant-disarmament people and those who would commit us forthwith to armament on the European scale, is that they seem to lack a sense of proportion. The question of the proper scale on which the naval and military forces of this country should be laid down is both complicated and difficult, and the cause of much of the present confusion and silly talk is to be found in the fact that people have looked merely at one phase of the question, and have talked and written about it until a small part has come to stand in their minds for the whole question. Says one, "we are a peaceable and peace-loving people, fair and just in our dealings, and we look upon war and all brute force with abhorrence. To build battleships and multiply regiments is to do violence to our instincts and traditions and give the lie to our professions and deepest convictions." At the other extreme we find men who tell you that, since this country is the richest, most progressive and most independent on the earth, and would be quick to resent the slightest opposition to its national policies, we ought to possess a fleet greater even than that of Great Britain and an army rivaling those of the continental nations.

Now the SCIENTIFIC AMERICAN is of the conviction that the wise policy for this country lies somewhere between those extremes. We believe that the provision of a navy sufficiently powerful to dissuade any foreign power from venturing across either ocean to attack us—a navy which, in the make-up of its units and in the strategy of its active operations, would be designed, first and last, for defense and not for aggression—and the provision of a standing army, with the proper reserves, of sufficient strength to preserve the peace within our own borders, to man our coast fortifications, and properly to garrison our outlying possessions—should be one of the very first objects of the Federal Government.

The question arises, then, has Congress fulfilled its fundamental obligation; do we possess naval and military forces of sufficient strength and efficiency to protect the United States and its outlying possessions against aggression, and enable the country to work out its national ideals, develop its national resources, and carry on a world-wide commerce, without fear of let or hindrance from any foreign power?

If we face that question squarely and give it a truthful answer, it will have to be said that, throughout the century and a quarter of the life of this Republic, from the days when Congress turned a deaf ear to the pleadings of Gen. Washington, down to the present hour, Congress, so far from making adequate provisions for the naval and military defense of this country, has either ignored the warnings of its military advisers altogether, or has granted a pitifully small proportion of the appropriations asked for this vital purpose.

The neglect of our defenses has not been due to any one political party. Whig and Tory, Democrat and Republican, each and all, in their turn and at various times, have played fast-and-loose with the question of national defense.

In the present hour, when there is widespread evidence that the nation is thoroughly aroused to the serious nature of the conditions, it should be clearly understood that nothing will so greatly imperil the success of this movement for national security as to make it the football of party politics. It should be considered as a great national question, and as such the people and its Congress, and our distinguished Executive himself, should join in the discussion of this matter, and the righting of that which is wrong, with something of that noble unity of purpose with which the various nations of Europe have rallied to the flags of their countries in an hour of supreme danger.

And, just here, we are reminded that a fear has been expressed in high quarters that, if we begin the discussion of this question at the present hour, our attitude may be misconstrued by the warring nations of Europe, as having in it something of a menace, or as at least suggesting that we think our entrance into the conflict is not an altogether remote possibility.

In reply to that, it is sufficient to impress firmly in the minds of the public that the insufficiency of our naval and military forces has been long and intimately known to everyone of the leading powers of the world—better known to some of them, indeed, than it is to many people, and possibly to many Congressmen, in this country. If we set about strengthening our navy by making it a little better balanced than it is, and bringing our army up to the very modest strength and numbers which would be sufficient for purposes of defense—the only comment that this movement would excite among the naval and military men and the diplomats of Europe would be an expression of surprise that we had not done this necessary thing many years ago.

The Ups and Downs of War

AN ordinary map, such as the political maps in our atlases, gives quite inadequate information as to one of the most important factors in military geography, viz., relief. The actual presence of mountains is, indeed, shown by the customary hatchings, shadings, or on the best charts, numbered contours; but these devices give only an approximate idea of the suitability or unsuitability of the country for military operations. Minor elevations, especially those small but abrupt asperities that constitute ordinary "broken" country, are generally not shown at all. Roads of all kinds may be duly marked, but without definite indication of their gradients. Yet without this information the movements of an army are often perfectly unintelligible. Even the armies of antiquity, with no artillery and no heavier transport than the ox-cart, were compelled to limit their marches to routes of moderate slope, such as are the historic "routes of invasion"; while the armies of to-day, with their colossal guns and fleets of motor vehicles, are far more closely tied down to favorable routes, including, of course, railways wherever these exist.

In view of these facts it seems opportune to investigate the relief of the land in the principal theaters of the present war, together with some of its effects on operations.

The Franco-German frontier is almost wholly mountainous or hilly, and this explains at once why the Germans chose for their principal route in invading France the flat lowlands of Brabant and the gently rolling high plains of Hainaut. The barrier to the eastward is, indeed, pierced at certain points by inviting passes, with admirable roads, such as the historic Lorraine and Burgundy "Gates"; and the history of the war shows that the presence of great French fortresses at these "gates" would not have seriously retarded the invading armies. In the old days such mountain passes or valleys were clearly marked out as routes of invasion, but to-day their importance is much diminished, because the size of a modern army necessitates advance along a broad front, i. e., along many parallel and interconnected roads. This change in the conditions of warfare is strikingly brought out by an article in the SCIENTIFIC AMERICAN of November 7th, page 386, where it is shown that if the invading German army of approximately 1,200,000 men had been confined to a single road in entering France, marching at the normal rate of twelve miles a day, the process would have required one hundred days. It looks, indeed, as if Belgium offered not only the easiest route of invasion, but the only possible route for a rapid invasion under modern conditions. Again, if the French had undertaken to invade Germany—i. e., to strike at the heart of the empire, and not merely overrun parts of Alsace and Lorraine, as they did—the Belgian route would have been even more imperatively indicated. The wide mountains of the Ardennes and the Vosges that bound the eastern advance on Paris is as nothing to the succession of hills and mountains, powerfully defended by military art as well as nature, which lie between the Franco-German frontier and Berlin. France may count herself extremely lucky that Belgian neutrality was violated by her enemy, thus opening to herself the only practicable road for striking back, when the time comes.

Besides the main invading force above referred to, auxiliary Teuton armies did, indeed, enter France by way of the more northerly of the passes in the eastern frontier, viz., through the Moselle Valley and Luxemburg, and along the Marne Canal in the neighborhood of Lunéville and Nancy. Once fairly in France, the combined German armies were aided by the slope of the land in their advance on Paris, for they were marching down the northern watershed of the Seine, especially along the valleys of the Oise, the Aisne, and the Marne. This advantage of topography helps to explain their rapid progress.

When the tide turned the Allies accomplished what appears, at first sight, to have been the remarkable feat of driving the invaders back almost as fast as they came, over rising ground and across some deeply cut river valleys, as far as the still deeper valley of the Aisne. It seems probable, however, that the Germans, having been forced to assume the defensive on account of the withdrawal of part of their troops to the Russian frontier, and also on account of the reinforcement of the Allies and the danger of being outflanked, made no serious attempt to stand against their opponents until they reached well-prepared and naturally defensible ground, from which, at this writing, they have not yet been dislodged.

Southeastward from Verdun, as far as the Swiss frontier, the line of battle has not shifted materially since the early days of the war. Had they advanced in this quarter from their strong positions in the Vosges, the Germans would have been confronted with the task of crossing the rugged country of the Argonne forest in the north and the Langres plateau in the south. Upon Verdun as a pivot, the bulk of the German army, operating west of that point, executed in August and September a huge swinging movement down the gentle slopes of the Seine basin, over magnificent roads; followed by a swing northeastward to the border of the Paris basin, where, with their back to the highlands of the Ardennes, they are in an excellent position for a prolonged defense. All the movements above described appear to show that relief controls to an unprecedented extent the operations of modern armies. In obedience to the same control, the heaviest fighting has now shifted to the plains of Flanders, where neither side has any important advantage of topography.

The Russian-German and Russian-Austrian frontiers run through level country; the former through a low plain, the latter through a plateau of moderate altitude. An incursion from Russian Poland into Germany offers the invaders a slight advantage of slope, as the river valleys are directed toward the interior of the latter country, the Oder, especially, forming a great highway toward Berlin. East Prussia offers other topographic obstacles to invasion than those of relief, for it is a wild, sparsely settled country, heavily forested, and interspersed with lakes and bogs. Unless conquered, however, it would form a standing menace to the communications of a Russian army entering Germany from western Poland, and the same may be said of the much less forbidding plateau of Galicia, which has already been overrun by the Russian forces. The great bulwark of Austria on the north is the range of the Carpathians, the principal passes of which are from 2,000 to 3,000 feet above sea-level. If the Russians can effectively occupy East Prussia, and hold back the Austrians along the Carpathians, their further task of invading Germany will not be conditioned to any extent by the relief of the country.

A word may be added as to Armenia, which has recently become one of the arenas of the war. This region is a lofty plateau, with a general altitude of 6,000 feet, from which rise innumerable rugged hills and mountains. There are no railways, and hardly any roads except bridle-paths. Much of the country is very imperfectly mapped. The main hope of successful invasion of this region is the co-operation of the Armenians, who have been so shockingly maltreated by the Turks, and are now offered an opportunity of paying off old scores.

Award of the John Frick Medal.—At the last annual meeting of the American Society of Mechanical Engineers, New York, the John Frick Medal was awarded to Prof. John E. Sweet, honorary member and past president of the society, "for his achievements in machine design and for his pioneer work in applying sound engineering principles to the construction of the high-speed steam engine." The John Frick Medal is awarded by the four national engineering societies.

Engineering

Secretary of War Appoints Director of Public Works.—Secretary of War Garrison has just announced the appointment of Major General William Weigel Wotherspoon to the position of Director of Department of Public Works for New York. General Wotherspoon was recently Chief of Staff of the United States Army. The general is to have a free hand in the conduct of the department, and thereby is assured to New York the certainty of an efficient and economical administration in one of its most important public offices.

Sixteen-inch Coast Defense Gun.—The Chief of Coast Artillery recommends the construction of 16-inch 50-caliber guns for the new fortifications of Cape Henry. This gun will be vastly more powerful than the 16-inch gun which has been sent to Panama. That gun is only 35 calibers in length and has a much lower muzzle velocity than the proposed new 16-inch gun. Brig. Gen. E. M. Weaver, Chief of Coast Artillery, believes that in view of the fact that foreign warships are mounting 45-caliber guns of 15-inch caliber it is now necessary for us to outrange those guns with powerful 50-caliber, 16-inch pieces.

The Need for Light Naval Cruisers.—No class of vessel has distinguished itself more during the present war than the light cruisers of the type of the British "Undaunted" and the German "Emden" and "Karlsruhe." It is a most serious omission that the Navy programme of construction for this year makes no recommendation for the construction of any of these craft. At present we have but three of the moderate speed of 23 to 24 knots. These vessels are the eyes of the fleet. The dreadnought cannot realize its full efficiency without them. We note that the *Morning Post* naval correspondent expresses surprise that none of these most efficient vessels should have been asked for in this year's programme.

Cracks in Railway Tires.—Thermal cracks in railroad tires are attributed by the Interstate Commerce Commission largely to the action of the brakes. The tread is suddenly heated, and the tire, expanding before the center is affected, causes wide fluctuations in the magnitude of the shrinkage strains. Momentarily the tire may be left with very little shrinkage resistance when there is a sudden application of the brakes. Even more important is the fact that thermal cracks are formed in the steel in this manner, and the presence of these is a menace to the integrity of the tire. They are caused by the rapid cooling of the intensely heated metal where free contraction is resisted.

"Safety First" Saves Life and Limb.—The recent annual report of the Public Service Commission of New York State shows that the "Safety First" movement is producing excellent results. There is a decrease of over 72 per cent in passengers killed on steam railroads in the State of New York during the past year, as compared with the year preceding. There is a decrease of 45 per cent in passengers injured. In 1913 fifty-one passengers were killed, last year only fourteen. During the past year 943 passengers were injured as compared with 1,746 in the year before. There is a gratifying decrease in casualties among railroad employes; 196 were killed and 3,022 injured last year, as compared with 250 killed, and 3,076 injured the year before.

The Most Powerful Electric Passenger Locomotive.—During the year sixteen powerful electric passenger locomotives have been placed in service on the main lines of the New York Central Railroad. They are the most powerful passenger locomotives in existence, and each is capable of hauling a train of fourteen steel Pullman cars continuously at a sustained speed of 60 miles per hour; while with lighter trains a maximum speed with these locomotives has been obtained of 85 miles an hour, these speeds having been accomplished frequently on the experimental track of the company near Schenectady. All the wheels of the locomotives, including those on the leading and trailing trucks, carry motors, the whole weight being thus available for producing tractive efforts.

The Latest of Our Great Railway Stations.—Nowhere are there to be found such noble terminal and union station buildings as now exist in the United States. Foremost among these are the new Pennsylvania station and the new Grand Central Station in New York; but outside of this city there are other monumental buildings which are scarcely second to the two mentioned in importance. The latest of these to be opened is the Union Station in Kansas City, Missouri, which was opened to traffic on November 1st of this year. The building, of classic design, is monumental in size and of dignified and harmonious proportions. The central portion of the building contains a main hall 240 by 103 feet and 80 feet high. The waiting room is 350 by 75 feet. The west end of the station, approaches, new belt line and the new terminal works represents an output of over forty million dollars.

Science

Vulcanized Rubber for Vulcanizing Rubber.—Dissolved rubber can be vulcanized without the use of heat, and can be kept in a semi-liquid state, although vulcanized, by a new method discovered by a German chemist, Dr. M. Heilbronner. Rubber is dissolved in a light hydrocarbon solvent, best in the proportion of 15 parts of solvent to 1 of crude rubber. A solution of crystallized sulphur in benzine is then added to the rubber solution and the mixture is subjected to the influence of ultra-violet rays, obtained by a Cooper-Hewitt mercury vapor lamp in quartz tubes. The rubber in the solution combines with the sulphur and when the solvent is allowed to evaporate the residue is pure vulcanized (insoluble) rubber. For repairing, the vulcanized solution is used and the solvent is evaporated, giving a sort of "autogenous rubber welding" which fails to disclose the points of contact. Where two rubber surfaces are joined by this vulcanized rubber solution a homogeneous mass is formed.

The Congo Expedition of the American Museum of Natural History, under Messrs. Chapin and Lang, which has been working for the last four years in co-operation with the Belgian government, has now completed the task of making the largest and most valuable collection of the Congo fauna ever assembled, including more than 5,000 specimens, in addition to about 15,000 invertebrates. A telegram from the explorers, dated September 30th, stated that it would require three months to finish the work of repacking the collections at Stanleyville, the principal headquarters of the expedition, and to ship them down the Congo River to Boma, from which place it is hoped to send them by a neutral ship to New York. The Museum announces that, with this prospective addition, its African collections will no longer need large additions, and field work in Africa will be discontinued for the present.

Dehydrated Vegetables are described in the latest annual report of the Quartermaster-General, U. S. Army, as having been recently introduced experimentally for the subsistence of the troops, and as giving far better satisfaction than the desiccated vegetables which were tried some years ago. The distinction between desiccation and dehydration is not made clear in the report, which simply states that "fresh vegetables are now dehydrated under a new and improved process." After soaking and cooking, the vegetables closely resemble the fresh product both in taste and quality. As 1 pound of dehydrated potatoes equals about 6½ pounds of fresh, and 1 pound of dehydrated onions about 12½ of fresh, it is evident that the use of these prepared vegetables in the field will mean an immense saving in transportation. The dehydrated products include beans, carrots, maize, onions, beets, potatoes, tomatoes, turnips, etc.

Goldenseal (*Hydrastis canadensis* Linn.), formerly common in open woodlands in the middle eastern United States, has now become scarce on account of the large amount collected by gatherers of medicinal plants. The root of this plant was commonly used by the Indians and early settlers as a remedy for sore throat and inflamed eyes, and also as a bitter tonic in stomach and liver disorders, but there was little commercial demand for it until about 1860, since which time it has not only come into widespread use in this country, but has also been exported in considerable quantities. In 1880 crude goldenseal brought from 8 to 12 cents a pound, while during the past three years the price has ranged from $3 to $4.25 a pound. The annual consumption is estimated at between 200,000 and 300,000 pounds, of which one-tenth is exported. In view of the foregoing facts, the Department of Agriculture is trying to interest farmers in cultivating this plant, and has issued a manual of instructions on the subject.

The Twenty-first International Irrigation Congress, which met at Calgary, Alberta, last October, adopted a resolution in favor of amalgamating this series of congresses with the International Dry-farming Congresses. It is expected that definite action will be taken on the subject at the next annual meeting, which will probably be held either at Galveston, Tex., or Oakland, Cal. The Irrigation Congress was founded 23 years ago for the purpose of arousing public interest in the subject of revising the irrigation legislation of the western States, and of inducing the Federal Government to inaugurate a national policy of arid land reclamation. Largely through the efforts of this organization, nearly all the western States and Canadian provinces have enacted irrigation laws based upon sound legal principles and well adapted to develop the resources of the country, while the United States and Canadian governments have now fully committed themselves to the policy of irrigation. The twenty-first congress also took action to discourage unprofitable irrigation undertakings; it was resolved that no large project of this character should be entered upon by the State or Federal governments unless it appears from a preliminary examination by experts that the undertaking would yield at least 3 per cent on the total investment.

Astronomy

Lord Rosse's Telescope, the famous 6-foot reflector which has been depicted in most books on astronomy for the last 70 years as the largest telescope in the world, has been presented to the Science Museum at South Kensington. It has been little used for many years.

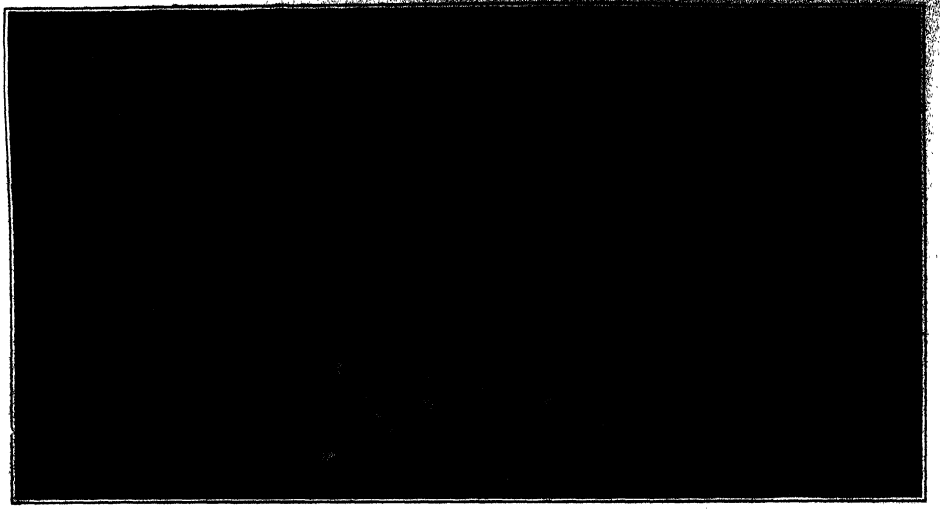
The Ninth Satellite of Jupiter, which was discovered photographically at the Lick Observatory last July, has now been determined to have a period of about three years, a retrograde motion, and a mean distance from the primary of about 18,900,000 miles. It was found last summer to be of about the nineteenth magnitude. This tiny body is farther from its primary than any other satellite in the solar system thus far discovered. The eighth satellite of Jupiter comes next, with a mean distance of 15,000,000 miles, and the ninth satellite of Saturn third, with a mean distance of about 8,000,000 miles. It is noteworthy that all three of these satellites present the anomaly of retrograde motion.

Encke's Comet.—It is reported that Encke's comet has been observed from the Russian observatory at Simeis in the Crimea. It will be remembered that this is a short period comet of about three and one third years. Encke first calculated its elements, although Pons, of Marseilles, first observed it. Halley's comet, which preceded Encke's by sixty-three years, was the first comet recognized as periodic, and Encke's was the second. Encke's comet was also the first example of a new class of celestial objects revolving around the sun within the orbit of Saturn and exhibiting certain planetary affinities in the manner of their motions. Its return was expected this autumn and the Russian report states that it is situated in the constellation of Perseus.

The August Meteors.—In a pleasantly written account of "Perseids and Leonids," contributed to the Journal of the Royal Astronomical Society of Canada, Mr. W. F. Denning, the veteran English observer of meteors, tells, among other things, why people have been disappointed in recent years in looking for the Perseids on August 10th. The fact is that the best night is now usually the 11th or 12th; the date advancing with the progress of time, at the rate of about one day in a century. Thus the first historical shower of Perseids was on July 25th, A.D. 811. In 1914 the first oncoming members of the group were seen July 14th, and the latest traces of the display August 20th, but the maximum was on the 11th and 12th. As to the Leonids, which come in November, very few have been visible in recent years.

The Sidereal Center of the Universe.—Canopus, a brilliant star visible in southern latitudes, seems to have acquired a hitherto unsuspected importance as the result of some observations of Mr. O. R. Walkey, communicated to *Knowledge*. The helium or B stars, which are separated at vast distances from us, are free from preferential motion or star streaming, and in discussing their positions in space Mr. Walkey is led to conclude that peculiar interest is attached to the star Canopus in that it occupies the approximate position derived for the center of the stellar system. A number of concordant facts go to show that Canopus does occupy this central position: its distance is of the same order as that indicated for this helium star center; it is stationary with respect to these helium stars; its luminosity and mass are in character with their suggested significance, together with other facts all pointing in the same direction.

The Total Radiation from Sun and Sky.—While solar radiation, though known to be a most important factor in weather and climate, is measured regularly at comparatively few meteorological stations, the places are still fewer at which measurements are made of the total radiation from sun and sky, a datum that will probably some day be regarded as indispensable in weather records. A series of such observations was made at Mt. Weather, Va., from May, 1912, to September, 1914, by Prof. Kimball, of the Weather Bureau. During this period it was found that with the clearest sky the total radiation per square centimeter of horizontal surface varied from 250 calories a day on December 30th to 755 calories a day on June 10th. The average daily radiation in summer, including rainy and cloudy as well as clear days, was about 68 per cent of that received on the clearest days, and in winter about 63 per cent. At noon, with a clear sky, the total radiation per minute per square centimeter of horizontal surface varied from 0.77 calorie in December to 1.55 calorie in June. Lastly, it was found that at mid-day, in summer, about 18 per cent of the total radiation received on a horizontal surface was diffuse sky radiation, while with a hazy sky about *one-third* of the total daily radiation was received in this way. The latter figures seem to show that observations which take account only of direct solar radiation are of limited value for most of the purposes of meteorology and its applications; e. g., to plant physiology. The instrument used at Mt. Weather for measuring the total radiation from sun and sky received on a horizontal surface was the Callendar horizontal recording pyrheliometer; by using a screen to eclipse the sun at intervals this instrument also served to measure the radiation from the sky alone.



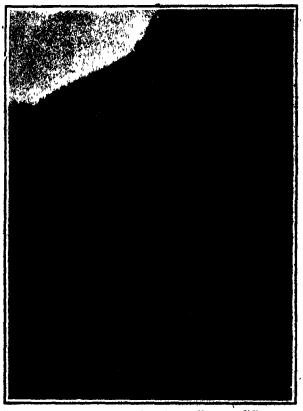
Looping the loop on the Farovia del Bernina, in Switzerland.

Looping the Loop in the Alps

By J. F. Springer

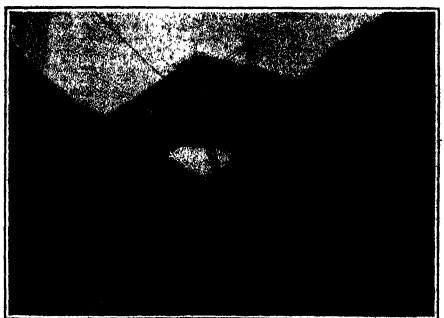
THE country and population of Switzerland are not large, but the development of the nation is that of an exceptional people having an exceptional environment. There are no coal mines, no oil wells; in short, no adequate natural supply of any industrial fuel. Of course coal and oil may be bought; but this is unsatisfactory, as it makes progress dependent, in part, upon the good will of others. It is fortunate, not to say providential, then that Switzerland possesses a wealth of usable water powers. In fact, there would seem to be ultimately available a total water-power energy of 600,000 or 700,000 horse-power, and apparently Switzerland has sufficient hydraulic energy to operate all her railways, present and prospective. It is necessary, of course, that this energy should first be converted into electric current and then utilized. Switzerland is coming to realize the value of her source of power and is beginning to apply it to railway operation. However, a great fact has to be considered here. The commercial utilization of hydraulic power turns upon the local price of coal, and it has been found cheaper, for the present, to continue steam operation as a general method. However, political considerations do have weight, and the price of coal continues to advance; so that these considerations will in the long run bring about a general electrification of Switzerland's roads. In the meantime, no doubt, because of special considerations, many electric lines are being constructed.

One of the most notable of these is the Berne-Loetschberg-Simplon Railway connecting Spiez or Thun in the Bernese Oberland with Brieue in Valais, a distance of about forty-eight miles, connecting with the Simplon Railway. This new road joins the comparatively low country in the heart of Switzerland on the north with the valley of the Rhone on the south. To carry out this junction of two moderately elevated districts separated by rugged mountains, it was necessary that the track should mount to a considerable level, and should, in addition, pass by tunnel through an insurmountable intervening mountain. At about its middle point the railroad passes through the celebrated Loetschberg Tunnel at an elevation of 4,000 feet above the sea, and the construction of this tunnel is to be rated as one of the most notable achievements of modern engineering. The Loetschberg Tunnel is nine miles long, and it is neither level nor straight, the central four miles passing through the granite backbone of Europe.

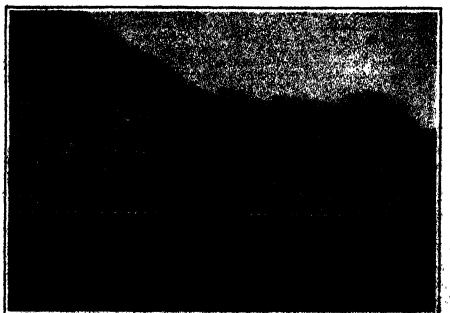


Viaducts carrying looped railway line at different levels.

One of the most notable features of the railway lies to the north of the great tunnel. The conformation of the country is so extremely complicated that, in order to attain the elevation of the tunnel, it became necessary for the road to double twice upon itself all in the space of a mile and a half. This is one of the most intricate pieces of railway curving in the world. The line at first runs along almost due south. After a little it swings off westerly and makes a complete loop, after which it runs almost due north. After a time it circles around to the east and completes a second loop. Both loops are pear-shaped, with the small ends toward each other. Between the loops are three separated lines of track, all roughly parallel. After the swing eastward of the second loop and the completing curve bringing the track westward again, the line moves off to the southeast. Let it be realized that the two pear-shaped loops and the three parallel intervening sections of track are all included in an over-all length of 1½ miles. The whole has a plan appearance of a figure 8 or of a dumb-bell, and there is at various points an opportunity to view the same scenery two or three times. It should be



The Bietschtal bridge on the Loetschberg Railway, which connects the Bernese Oberland with the Simplon route.



Along the new Loetschberg Railway. Three levels of the line can be seen, one above the other, as it climbs from the valley to the tunnel through the Alps.

...meandering of the track ... in all their looping the ... which the track crosses ... and way between the two loops ... immediately recrosses upon ... it is interesting to know, considering the extremity of a tunnel about a mile long, the radius of the main curve having a length of about 1,000 feet.

A short distance after you have double-looped the ... rising higher as you go, you enter the Lootschberg Tunnel and pierce a heavy ridge of the Alps. When about half way through the tunnel, you will have attained the summit of your journey, and you then descend to Brigue, where you may change to the Simplon Railway and pass through a tunnel even more marvelous yet.

It will readily be understood from the foregoing example that railway construction in the Alps involves some unusual, not to say extraordinarily difficult, problems. The swinging round a loop is probably, in most cases, an engineering necessity. And yet, it must be confessed that it adds picturesqueness to the view, and so is not to be deprecated in a country where a large part of the business is the attraction and care of visitors. A curious-shaped bridge may have its form largely controlled by necessity. Still, it fits in with the general scheme of things. An example of this is the steel bridge across the valley of the Bietsch. This bridge is on the southern part of the railway and spans a steep and narrow ravine.

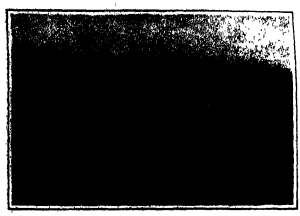
Other Alpine railways have of course similar conditions, and as an example the Ferovia del Bernina may be cited. Near Brusio there is a curious and beautiful system of curves. Apparently, the engineers had to effect a sudden elevation of the route, so the line was run off to the right and then swung round a fairly perfect circle, with the grade rising progressively. As the curve swung round to cross at the point of beginning, a viaduct became a necessary feature. This viaduct of seven or eight arches is built in the form of a curve with the roadway continually on the rise. The route, now considerably elevated and yet at the same plan location, continues the curve and thus swings up onto the desired location. The form of the loop is a rough spiral. From an engineering point of view, we may regard the spiral railway as performing the service of an elevator. A sudden rise is needed, but the train must follow a very moderately inclined track. The solution is to wind around up a spiral.

Reinforced Concrete Pontoon

By Oliver Johnson

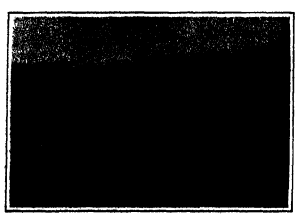
SOMETHING new in the engineering world has recently been accomplished at Circular Quay, Sydney, N. S. W., where a reinforced concrete pontoon has been constructed in connection with the building of a large jetty, on behalf of the Sydney Harbor Trust, for the Paramatta River and McMahon's Point ferry service, instead of the old style timber-built pontoon, and it is claimed that the one constructed of reinforced concrete, at very little extra cost over the old timber style, will practically do away with all maintenance expenses. Submarine growth will exercise no injurious influence on this concrete pontoon, which is the first of its kind in Australia. Hitherto the only concrete pontoons employed anywhere were those in the making of the Panama Canal, but their construction was entirely different from the Sydney pontoon, as the Panama pontoon was used primarily because of the difficulty in obtaining suitable timber. The Sydney Harbor Trust chose the reinforced concrete design, believing it to be a great improvement on the timber kind. It is working well and giving every satisfaction.

The dimensions of the pontoon are: Length, 110 feet; width at the bow, 53 feet 3 inches, and at the stern, 67 feet 7 inches; depth, 7 feet 9 inches; deck area, about 6,000 square feet. The total displacement of the pontoon, with shed and ramp, is 763 tons. In the structure were employed 342 cubic yards of concrete and 43 tons of steel rods. The thickness of the concrete varied from 5 inches on the bottom, sides and deck, to 4 inches in the bulkheads. The decking under the ramp seating is 8 inches thick. The pontoon has been roofed over and subdivided by a fixed barrier between two sections, and there are also subdivisions for sliding gates, swing gates, and barriers. Fenders safeguard the pontoon against the impact of vessels. The twelve piles that keep it in its place were driven 22 feet into the mud, through water 30 feet deep at high tide.



Finished pontoon on building ways.

There are forty-four water-tight compartments, making the pontoon practically unsinkable. Underneath the bottom, however, runs a network of galvanized iron chains, with strips around the piles. The pontoon of the deck immediately joining the landing has been coated with Val de Travers asphalt, and the remainder have plain concrete, like a foot path.



Reinforcement of floor and sides of the pontoon.

The pontoon was built level on a launching cradle on five fixed ways, and great difficulty was experienced in starting the cradle. Two tugs, two hydraulic jacks, and five screw-jacks were unable to move it. Battering rams were requisitioned and resulted in a first-class launching. An examination subsequently disclosed that the obstruction had been caused by some mischievous person having driven two hidden bolts or nails into the sliding ways.



Method of subdividing the pontoon by bulkheads, and some of the deck reinforcements.

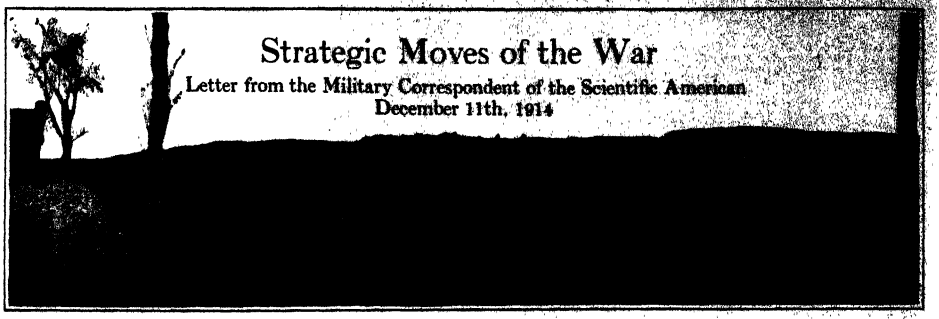


The concrete pontoon, finally launched after great difficulty was experienced in starting the cradle.

The Cause of Neuralgia

By Dr. Leonard Keene Hirshberg, A.B., M.A., M.D. (Johns Hopkins)

PROF. L. Edinger of the Neurological Institute in Frankfort, describes different morbid changes which may produce neuralgic pains in the lower extremities, often grouped indiscriminately as sciatica, and the better acquainted the physician becomes with these the less likely is he, in practice, to meet with cases of neuralgia pure and simple, for the obvious reason that the underlying pathological state does not escape him. Insufficient examination is, however, only too prone to lead to failure in treatment if once so comprehensive a diagnosis as sciatica is made, content with that, the spirit of investigation seems to go to sleep. Prof. Edinger describes several incidences that have recently come under his notice with a ready-made diagnosis either of sciatica or of crural neuralgia, not the diagnosis, but the failure to effect a cure, led to them being sent him. Yet until the etiology was recognized therapeutic endeavor was necessarily fruitless. One of these incidences was that of a healthy man, aged twenty-two, who received a kick on the left shin just below the knee when playing football; unfortunately, an iron fire-screen fell on exactly the same spot not long after, with the result that, following on a severe local hemorrhagic effusion, acute pains developed in the limb, on which eight weeks' rest in bed and numerous forms of treatment had little or no effect. For no less than three years the pains continued in spite of every attempt to relieve them. The patient was able to cycle for some distance, but the pains came on if he had to climb an ascent. He was able to ride, on horseback, though pressing his knee against the horse's side induced the pain. He could walk upstairs quite well and always felt the pains worse if he stood for any time. The contradictory nature of the complaint, as it appeared to some physicians, had led to a diagnosis of hysteria. There were no signs of organic nervous disease. Prof. Edinger noticed on examining the patient that some superficial veins over the calf were dilated, and the idea of a varicose condition of the veins of some nerve trunk, or in the neighborhood of a nerve trunk, came to him. The simple application of an elastic bandage effected a speedy and permanent recovery. Another instance was that of a medical man, aged fifty-six, who, after a chill, developed so-called sciatica in the left leg. Yet the pains were worse on standing or sitting, while walking always relieved them. They were localized mainly on the back of the knee, but were also felt in the back; their frequent appearance at the head of the leg led to a diagnosis of bone neuralgia, but this the patient himself would not accept, although it was clear that they began in that region. The whole leg below the knee ached, while pressure on the sciatic nerve at the sciatic notch was painful. The pains were always alleviated by walking upstairs and aggravated by standing or walking slowly. Every conceivable treatment for sciatica was at one or other time utilized, but without result. The patient, however, was one day examined in a standing attitude, when small varicose veins were noted on the back of the knee and a diagnosis of deep varicose—twisted—veins made. It will be seen that the possibility of a deep varix, either in or near a nerve trunk in ambiguous incidences of crural neuralgia, is well worth keeping in view



Strategic Moves of the War

Letter from the Military Correspondent of the Scientific American
December 11th, 1914

Austrian battery in a redoubt commanding an entrance to a suburb of Przemysl.

The Campaign in France.

THE deadlock in France has continued for still another week without a noteworthy advantage for either side. Both sides have been sparing their men, and have been content to hold to the present lines while completing their plans for more active operations later on.

This has by no means resulted in complete inactivity, however. Neither side is willing to allow the other a free hand. Consequently, the opposing armies keep in close touch with each other by aerial reconnaissances, by sapping and mining, and in favorable cases by surprise attacks.

This compels the retention of strong garrisons in the trenches and tends to prevent the strategic concentration of force in one part of the line by stripping other parts of defenders. Surprise loses much of its military value, and the fighting is reduced to a hammering and wearing contest in which victory will tend to rest with the side that has the greatest resources in men and munitions of war.

A long line like this cannot be controlled as a single string of companies. Warfare is a most involved matter in which small differences in efficiency of organization may have a deciding influence on the outcome. Since the earliest days of the human race man's most intense thought has been given to perfecting his fighting ability. His existence and his development have been achieved through this struggle. Consequently it is no wonder that the most highly organized human agencies are found in the armies of the great nations. In this industry alone can men actually be handled by millions and yet have their united energies guided toward one common end.

The German line is a good illustration of the organization by which such large numbers are controlled. The regiments are grouped into corps and the corps into field armies, each consisting of three to six corps. The field armies are grouped for command, so that the commander-in-chief will not have so many separate organizations to control.

One such group comprises the three armies that hold the line from the North Sea to the Somme River. Another is formed of the four armies between the Somme River and the Argonne forest. The extent of the third group has not been defined, but seems to run from the Argonne to the Vosges and to include the fifth, sixth, and seventh field armies. The troops in Upper Alsace and in the passes of the Vosges seem to form a separate command.

Each field army covers its assigned front. The corps divide up the length of line to be occupied, except that one corps is generally held back as a reserve. The corps front is divided between its two divisions, while the latter put a part of their strength in the trenches and hold out the rest as a reserve.

Thus, from the first trenches back to the general reserve there are successive lines of reserves that can in turn be thrown into any breach as needed. If the enemy attacks at any point the local reserves are first rushed in and then the reserves that can be spared from the adjoining portions of the front. If the attack is still pressed the larger reserves from the rear are moved up to check the enemy's advance.

The outcome of the minor assaults such as those that have occurred during the week can then rarely amount to more than a capture of a short length of the front trenches. The reserves rush up, stiffen the resistance of the defenders, and enable them to reform their line in a new position farther to the rear.

The majority of the reports reach us from French and British sources, and naturally the majority of the engagements reported are gains by the Allies. Even making allowances for this, the advantage in the fighting of the last week seems to lie with the French and British.

The developments of the week show a strengthening of the Allied forces without corresponding increase in the German strength. The British troops have been shifted to the north and occupy a front extending from near Dixmude to a point south of La Bassée. An unconfirmed report states that Gen. French is now in command of the left of the Allies' line from Arras to the coast.

In this district the British have started an advance and have pushed forward to Passchendaele, 7 miles east of Ypres. Such a move, coming soon after the dispatch of the British volunteers to the Continent, and at a time when the Russian situation demands energetic action in the west, may prove to be the beginning of an aggressive campaign for the recapture of the Belgian coast.

Such a campaign may be accepted as the first effort that the British will make after they get their volunteer army sufficiently trained for field service. It is of great importance to them to drive the Germans back from the Belgian seacoast, as the greatest danger to which the British transport service is exposed is due to the German submarines based on their harbor of refuge at Zeebrugge. If the Germans should be deprived of this vantage point they would have to depend for their submarine base upon Emden, 280 miles farther from the English coast.

North of Arras the French have regained the Chateau of Vermelles, which was lost in the fighting of October 16th. West of Craonne they have made a gain in the capture of Vendresse, half-way between Vailly and Craonne and three miles north of the Aisne. In the Argonne region the French have advanced to Vareunes, while the Germans have captured Malancourt. The positions along the Meuse River and along the Lorraine border have not been changed.

In Upper Alsace the French are making an attempt to recapture the district, but are meeting a very strong opposition. For two weeks they have been held fast to a line running from Thann to Altkirch. The Germans have countered with a move along the Swiss border that has carried them to Pfetterhausen, on the French border.

These two districts, Belgium and Upper Alsace, can well be watched, as the first signs of the adoption of an aggressive campaign by the Allies will be very likely to be shown in one or both of these fields. The reasons for an advance through Belgium are given above. The advance through Alsace would be attempted both for political reasons in order that the French can use an actual occupation of this territory when the peace parleys begin, and also because this is the point at which the French can most readily mass their troops for an effort to flank the German army.

An aggressive campaign by the Germans could most easily be carried out by a massing of troops near Arras or near Metz, due to the rail facilities in these two districts. The move against Arras would be intended to cut off the British army and to drive it back upon the coast. The move from Metz would call for a larger campaign directed against the whole of the French center.

The Campaign in Russia.

The week has seen a complete reversal in the rôle of the opposing armies in Poland. After their 15-mile retreat to the line between Skerads and Plock, running through Szadek, Sgiera, Sobota, and Gostin, the Germans reformed their lines and received a large reinforcement, reported as six army corps. Their advance was resumed with energy, and on December 6th they recaptured the important railroad center of Lodz. Farther north they reached Lowicz on December 8th, which carried the Army of Thorn up to within 50 miles of Warsaw.

The central German army based on Calisz and Wielun pressed forward at the same time and reached a point about 12 miles from Piotrkow.

On this line through Lods and Lowicz the Russians checked the Germans on December 9th. Both sides are rushing up additional troops as fast as possible to this decisive point in the battle. In this respect the advantage now lies with the Russians, who have undisturbed rail service running from Warsaw to the conscription districts of central Russia.

Meanwhile the Russians have been pressing their campaign against Cracow. Their army forced its way across the Donajec and advanced to Wielieska, five miles from Cracow. This resulted in a shift of Austro-German troops from the Czenstochowa line to the district south of Cracow, where they are making energetic counter attacks upon the Russian positions. The Russians report a defeat of this move in a battle 15 miles west of Novi Sandec.

North of Warsaw the Germans are pushing southward from Soldau, in East Prussia. They have captured Mlawa, and during the week made unsuccessful assaults upon Przasnycz, 25 miles to the east. In East Prussia the Germans are holding the Russians to the line through Johannisburg, Lotzen, Darkemen, and Gumbinnen.

Considering the line as a whole from the Carpathians to the Baltic Sea, the Germans are endeavoring to hold their flanks firm with reduced forces, while they are making their chances upon a plunge through the center with every regiment that can be mustered for this move. The Russians are countering by acting on the defensive in their center and on their right flank, while they are devoting especial efforts to pressing forward their left flank toward Cracow.

The Turkish Campaign.

The advance of Turkish forces to within 18 miles of the Suez Canal proves to have been made by a rapidly moving raiding party which quickly retreated to a safe distance from the canal. The British are now sending to the Isthmus their contingents from Australia and New Zealand, and have reinforced them with troops from India and Egypt.

The maximum strength that Turkey can concentrate for a campaign against the Isthmus of Suez is estimated at 85,000 men. Her great difficulty in such a move will be to maintain any large numbers. Not only must she supply them from a distance with food and ammunition, but also water, forage, and even wood must be shipped to the army from the end of the railroad over the difficult desert routes.

Along the Caucasian border the Russians have been fighting a defensive campaign since their retreat from Armenia. The Turkish efforts have been directed toward the capture of Batum on the Black Sea. They have captured Artvin on the Chorok River and have now advanced to the outskirts of Batum. On the Armenian frontier the opposing troops are still close to the boundary, except in the east, where the Russians have again crossed the boundary in the vicinity of Bayazid.

The British capture of Kurna at the junction of the Tigris and the Euphrates shows that they have advanced 100 miles up the Euphrates River. This is especially significant in its political effect in the disposition of Turkish territory in case of victory by the Allies in this war. Also the detachment of troops for this expedition indicates a confidence concerning the situation on the Isthmus of Suez.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Fog Signals Through Air and Through Water

To the Editor of the SCIENTIFIC AMERICAN:

On page 407 of your issue of November 14th, I notice an article on Fog Signals signed by Mr. B. B. West of Syracuse, New York, which is very interesting. There is, however, one thing that has been overlooked in this article, and that is the inevitability of sound waves in a medium like air which is not of uniform density. In air one is very apt to meet what are termed "silent zones" or what the sailors often call "ghosts." They may or may not exist at any given point, and if they exist may last only a very short while, and then entirely disappear. The result is that a steamer approaching a lighthouse in fog may at, we will say, 6 or 7 miles, hear the fog signal sent from a lighthouse where at 5 or 4 miles approaching on the same course the signal will not be heard. This apparently is due according to some of the best authorities to the existence of a stratum of air of different density from the air surrounding it, for instance, a layer of warm air rising or colder air descending. These layers reflect the sound so that it is conceivable that the sound starting from the siren could be reflected upward either from the surface of the ocean or by a light current of air and in coming in contact with a layer of air of different density be reflected downward again.

The matter of silent zones was carefully gone into by the United States Light House Board, and a very good report is given on the subject in the report of the Light House Board of 1894, Appendix V, report upon Fog Experiments, by William R. Livermore, Major of Corps of Engineers, United States Army.

I have myself several times had experience with these silent zones. Once running down Long Island Sound we heard the Execution Rock fog whistle, and suddenly lost it. It being very thick we anchored. As the fog gradually cleared we found we were within two or three hundred yards of Execution Rock, and the fog whistle came out very clear. The whistle had been going all the time, but apparently had jumped over our heads. The condition of silence on our boat lasted nearly three quarters of an hour.

There is one other objection to sound in the air, and that is the wind. Navigators often speak of being within a very short distance, sometimes inside of a quarter of a mile, of a powerful fog whistle, for instance, on Nantucket Lightship, being able to see the steam rise from it, and still not being able to hear the whistle because they were to the windward of the light vessel and a heavy gale blowing.

It was for these reasons that submarine signaling was developed because the water is for all practical purposes of uniform density, and these silent zones do not exist. Submarine signaling, with its ability to send out signals from moving ships, and have those signals picked up by other ships equipped to receive them, and also to obtain the direction from which the signal is sent, combined with the non-existence of any silent zones in the water, and the fact that currents in the water produce no measurable effect on the signal, renders this form of fog signaling the only reliable form.

Boston, Mass. ROBERT FULTON BLAKE.

Lightning and the Automobile

To the Editor of the SCIENTIFIC AMERICAN:

In your War Issue No. 3, I notice Mr. L. A. DeBlois' letter, from which it appears that he is of opinion that it is a fallacy to think that a motor car affords protection for the occupants from lightning. From my own experiments and experience I do not fully agree with Mr. DeBlois, inasmuch as the tires, while not being of sufficient insulation to withstand a discharge from a potential difference of "a million volts," are certainly of sufficient insulation protection not to increase the liability of the lightning's striking the car or its occupants, as would be the case were the wheels of some good conducting material in direct contact with the ground, or in the case of a person standing on that particular spot.

A good instance illustrating the protection afforded by rubber is a case that occurred in one of the parks in London some five or six months ago when several children, sheltering under a tree, were killed, while a man, also standing there, escaped unharmed. At the subsequent inquest it came out that he was wearing rubber soles to his shoes, and the coroner remarked that they probably saved his life.

If we bear in mind that a charged cloud passing over a section of ground causes to be exerted between itself and the ground an electrical strain or stress similar to that taken up by the plates of a charged condenser), which is taken up by every object in contact with the ground in proportion to its insulation and conductivity, until some object or some condition of the air reduces the distance or electrical resistance which allows the discharge and recombination of electricity, it follows, therefore, that any object projecting above its surroundings, so long as it is electrically insulated, as for instance by rubber tires, is not nearly as likely to attract the lightning as another object which is not so insulated.

Furthermore, has there ever been any case reported where the occupants of a motor car have been injured or killed by lightning? I think not, and automobiles are fairly numerous these days.

Santiago de Cuba. C. LANGLEY JOHNSON.

The White-winged Mexican Migratory Pigeon

To the Editor of the SCIENTIFIC AMERICAN:

West Texas just now (end of September) and the neighboring forests and fields of San Antonio, Texas, are invaded by the white-winged wild dove or Mexican pigeon. Large droves of them in certain districts near San Antonio can be encountered occasionally toward sunset, migrating from the large southeastern pastures and fields westward, to roost during night among the oak and mesquite trees in the extreme western regions. They are only temporarily met with around the fields and roosting places; but immense flocks of them were present six years ago, and also in 1888, I believe, when the farmers complained of them over the havoc they had done in their corn and sugar cane fields. They are exceedingly greedy birds. A few days ago, with some friends and in company with the owner of a large



Mexican white-winged migratory pigeon.

western pasture, I had the pleasure of observing large flocks of these rare and interesting wild pigeons, and shot down several of them during their flight over our heads. Two of them I subjected to a close range photographic reproduction, a few minutes after their capture, and a copy of these Mexican *"Palomas blancas,"* their Mexican name, is herewith submitted

Our Texas game laws are very strict in regard to shooting game, wild doves and quail, and large game in particular; but there is no restriction against the migratory Mexican pigeon. But these wild pigeons are not very easy to bag, either; generally they fly very high and swiftly over the fields to their roosting places, and it takes a good aim and quick shot to bring one down, unless one happens to strike a large flock of them. In general appearance these elegantly white-feathered pigeons resemble our Texas wild dove very closely; in fact, they are not very much larger and of the same beautiful light gray color of the entire body, only that both wings and the tip ends of the feather tails are marked with snow-white feathers, as seen on the photograph. DR. R MENGES.

San Antonio, Texas.

Aerial Tubers in Potatoes

To the Editor of the SCIENTIFIC AMERICAN:

In the November 28th issue of the SCIENTIFIC AMERICAN you note from a German agricultural journal the occurrence of "aerial tubers in potatoes." Aerial tubers are not at all uncommon in potatoes in some parts of this country They are due to a diseased condition of the stem, and are a sure indication of the presence of that disease. The diseased plant has a dwarfed stalk, and the underground tubers, if there are any, are few in number and very small. The disease has become more or less serious in many parts of Colorado. More detailed information, very probably, may be had from Prof. W. W. Robbins, State Agricultural College, Fort Collins, Col. W. H. HAAS.

Evanston, Ill.

Destruction of the German Pacific Fleet

THE German Pacific fleet which recently sank the "Good Hope" and the "Monmouth" was engaged off the Falkland Islands, in the South Atlantic, on Tuesday, December 8th, by a British squadron in command of Vice-Admiral Sir Frederick Sturdee, and defeated, the armored cruisers "Scharnhorst" and "Gneisenau" and the scout cruiser "Leipzig" being sunk, and the scout cruisers "Dresden" and "Nurnburg" escaping, presumably, in a damaged condition.

The action was made known in an official announcement by the British Admiralty, which reads as follows: "At 7.30 A M. on the 8th of December the 'Scharnhorst,' 'Gneisenau,' 'Nurnburg,' 'Leipzig,' and 'Dresden' were sighted near the Falkland Islands by the British squadron under Vice-Admiral Sir Frederick Sturdee. An action followed, in the course of which the 'Scharnhorst,' flying the flag of Admiral Count von Spee, with the 'Gneisenau' and the 'Leipzig,' were sunk The 'Dresden' and the 'Nurnburg' made off during the action and are being pursued. Two colliers also were captured. The Vice-Admiral reports that the British casualties are very few in number Some survivors have been rescued from the 'Gneisenau' and the 'Leipzig.'"

Later dispatches announced that the "Nurnburg" was overtaken and sunk, and that the "Dresden" had taken refuge in the Argentine port of Santa Cruz, in a badly damaged condition.

It is reported unofficially that the British fleet included some of the battle-cruisers of the "Indomitable" and "Lion" type. If so, the issue of the fight was inevitable In the absence of full official particulars, we reserve any comment upon this important action for a future issue.

Performance of French Submersibles

IT was in 1898 that the Schneider works began building the Laubeuf submersible boats for the French navy, and a number of successive types were constructed from that time on, such as the "Narval," "Sirène," "Aigrette," "Circé," and "Pluviose." Following the tests made in 1904, the submersible boat definitely and exclusively adopted by the navy was based upon the "Pluviose" type, which was then modified as time went on. We wish to refer to two remarkable raids made during naval maneuvers by the new submersibles. Start from Cherbourg for the port of Lorient or a trip of 283 miles without stop, then return to Cherbourg in the same way, blockade at Cherbourg for three days and three nights, then trip to Dunkerque and back without stop, making six days without landing. The last trip was made at an average speed of 11 knots. Second trip, made in the region of Brest and Cherbourg, covered 730 miles in eighty-two hours Quite a long voyage was made by the "Papin," and it covered the distance from Rochefort, on the west coast of France, to Oran in Algeria, or 1,230 miles, in six days, then proceeded to Bizerta, near Tunis, the entire distance being 1,800 miles, and this was made in fourteen days, landing only twice

A Valuable Research Prize

THE announcement has just been made by the Iron and Steel Institute of England that Sir Robert A. Hadfield, F.R.S., a past president of the organization, has offered a prize of £200 for the best research work on the subject, "The different forms or combinations of carbon in iron, steel and alloys of iron with other elements." This competition is open to everyone interested in metallurgy, and it is now intended to award at the annual meeting of the Institute in May, 1916, for the best paper submitted before February 1st of that year. There is a possibility that a second prize may be awarded if the second best paper is judged worthy. In speaking of the above matter, *Engineering* makes the following suggestions It is not desired to limit the scope of the research too closely, but it is suggested that the work should be in continuation of, or based upon, the work of previous investigators, such as Julien, Abel, Müller, Ledebur, T. Sterry Hunt, Akerman, Arnold, E. D. Campbell, Hoag, Parry and others. The object of the Research Prize is to stimulate the study of carbides in iron and alloys generally, also with a view to discovering the best method of determining the forms and combinations in which carbon occurs in iron and steel. These carbides are now spoken of by metallurgists in a general way, as sub-carbides, carbides, or double carbides. It is very desirable to define the composition of these more accurately and to ascertain whether other carbides exist which have hitherto not been identified. The study of the molecular constitution of the carbides will also fall within the range of the investigation, and, in this connection, attention may be directed to previous researches on particular combinations of carbon or forms of carbide. Intending competitors should communicate, in the first place, with Mr. G. C. Lloyd, secretary of the Iron and Steel Institute, 28 Victoria Street, London, S.W.

The Western Australian Goldfields

How Water Supplies Are Provided in a Waterless Country

By L. E. Shapcott

THE goldfields of Western Australia, which to date have produced over £115,000,000 worth of precious metal, and which contain one of the richest square miles of country the world has ever seen, comprise an area of 330,107 square miles, which is nearly three times the size of Great Britain and Ireland combined. A vast proportion of this territory, which ranges over a length of 1,200 linear miles, is comparatively waterless, and the task of providing water supplies throughout these regions provides a stupendous but not impossible problem for governments and engineers, a problem which has been faced with remarkable success by those who are carving out the destiny of this progressive but distant land. Under the egis of the government a water supply department has been established, one of the engineers devoting the whole of his attention to the goldfields water supplies. Throughout the length and breadth of the dry areas, where there is a reasonable prospect of finding gold or developing a goldfield, boring for water is undertaken, and afterward bore wells are sunk, larger wells are established with windmills and troughs, dams, or tanks are constructed, or huge conservation schemes are undertaken, and throughout what is known as the back country,

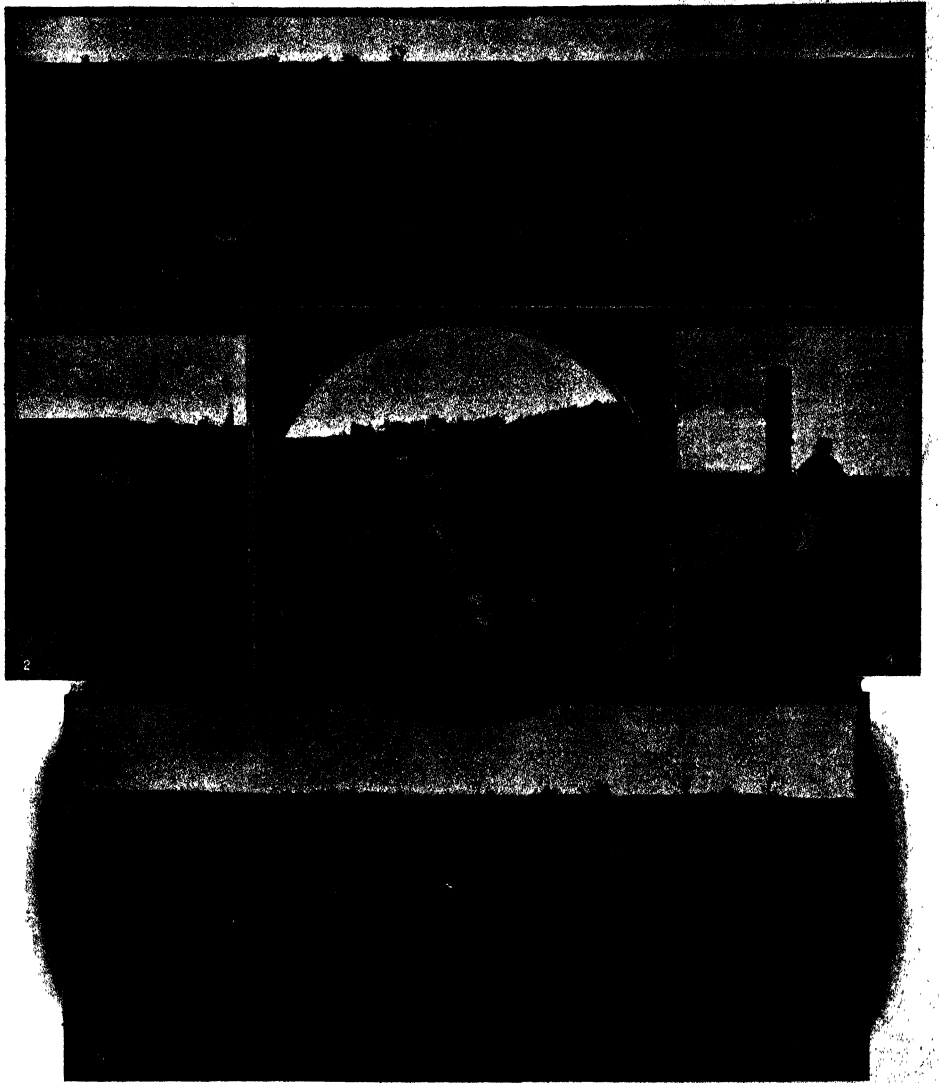


FIG. 1.—Laying the flooring of Kalgoorlie reservoir. FIG. 2. Molten pitch and asphalt delivered by bucket conveyor. FIG. 3.—The Mundaring weir. FIG. 4.—Dispatching a bucketful of molten paving mixture. FIG. 5.—Excavating the reservoir with camel-drawn plows.

How water supplies are provided in a waterless country.

...ments, mobile prospecting and ...ment, and the men have been ...ing to the work, which fortunately they ...

...ost important unit of the general scheme is ...ly augmented the goldfields water supply, which provides for the wants of 30,000 people in the Kalgoorlie and Boulder centers, and supplies the whole of the water used on the mines of the Golden Mile. Located thirty-six miles from the coast in the Mundaring Weir, the source of the supply. From this weir, water is pumped inland by means of eight water stations, through a 30-inch main locking bar steel conduit, to the eastern goldfields, a distance of 351½ miles, likewise feeding thirty-one towns and districts en route. The total length of mains laid down in distributing these supplies is 1,111 miles, and the average daily consumption is approximately three and one half million gallons. The scheme has a working delivery capacity of 5,000,000 gallons per day, and its total cost to date is £3,378,188.

The latest development of this branch of the water supply scheme is the building of a subsidiary 10,000,000 gallon reservoir at Kalgoorlie to guard against the possibility of a breakdown of the existing reservoir on Mount Charlotte, and a consequent famine; and the building of this dam constitutes a unique and interesting sight. Situated on a plain, the work of excavation, instead of being negotiated by the old method of pick and shovel and horse and dray, has been undertaken by means of camel teams, attached to plows and scoops. On this work, nine teams of nine camels each were engaged, the plows first breaking the earth, the scoops then removing it to the banks, where it is sprayed and rammed. Once the excavation was completed the process of lining and roofing remained to be negotiated, and these phases of the work are now in operation. The first lining of the dam has been completed, and the men are now engaged in laying the second covering of bitumen, asphalt and sand, which are mixed together and heated, and must be spread while in a liquid state at a temperature of about 400 degrees. About sixty men are engaged, chiefly on the lining. A number of large vessels, similar to the housewife's copper, are ranged round the dam for melting the bitumen and asphalt, to which the sand is added. The molten mixture is bucketed and dispatched at express speed along a wire line to a receiver below, who promptly deposits the mass on the floor in front of the men spreading the composition. The spreaders, heavily padded at the knees, and with trowels in hand, rapidly spread the mixture into position, where it immediately sets. This composition, on test, has been found impervious to leakage, and it has been used for many years by the Western Australian government with the utmost satisfaction. When the tank is lined, the roof will be placed in position, to afford protection from dust and evaporation. This reservoir is over an average width of 800 feet, 28 feet deep, and will contain 20 feet depth of water. The estimated cost of this work is £56,000, and it will be completed in 1914. The appearance of this work, and the operations of the gangs, constitute a scene of activity and enterprise, which is at once highly interesting and somewhat unique.

The goldfields water supply of Western Australia is one of the largest engineering enterprises ever undertaken in Australia, and for a population which now numbers only 220,000, it was a stupendous undertaking. As to the general water supply, it has worked incalculable advantages to the people of the State, and but for this beneficent agency, many millions of pounds worth of precious metal won from the bowels of the earth had never otherwise seen the light of day.

Thaumasite a Decomposition of Anhydrite

A RARE mineral known as thaumasite was first described by Baron von Nordenskiold in 1878 and was reported to be an unusual composition of carbonate, sulphate, and silicate of lime containing considerable water. In 1890 this mineral was again reported as having been found in quarries at West Paterson, N. J., where considerable quantities exist. Recently some specimens of a novel appearance were found there and came into the hands of Frederick I. Allen, a New York gentleman interested in mineralogy, and on examination an interesting relationship that has not been hitherto suspected was found to exist between anhydrite and the rare thaumasite. Mr. Allen's explanation is given briefly as follows:

"About a week ago specimens of a mineral of novel appearance were found at this place, and I obtained some samples which prove to be anhydrite, a sulphate of lime, and I find also that thaumasite was produced by decomposition of this mineral. The anhydrite is transparent and light blue in color and occurs surrounded by amethystine quartz, making unusually handsome specimens. Decomposition changes this mineral to a pure white crystalline mass of thaumasite, which remains in place and in the form of the original anhydride. Every grade of the change may be seen from the blue transparent anhydrite to the white thaumasite. The specimens leave no room for doubt that the origin of thaumasite was this anhydrite. The thaumasite has in many cases disappeared from the place of its formation and the resulting cavities in the quartz are in the forms of the original crystal masses of anhydrite. Specimens showing these right-angled cavities have been collected in large numbers and have been known as pseudomorphs. They may be seen in many collections and collectors have speculated as to what the missing crystal could have been. It can now be said that these right-angled cavities were first occupied by crystals of anhydrite either singly or in groups."

Alcohol as Fuel

By B. O. Jenkins

THERE has been so much written on the subject of alcohol as a motor fuel in the various technical papers that any further words would almost appear superfluous. I, however, present a short summary of the situation as it stands to-day with regard to the manufacture of ethyl alcohol as a fuel for internal combustion engines.

Very full details on the feasibility of manufacturing alcohol from potatoes were given in the reports of the Departmental Committee on Industrial Alcohol in 1905. The sum total of this most exhaustive inquiry was as follows: "We did, however, for special reasons take some evidence on the question of the production of spirit from potatoes, enough to satisfy us that in the present agricultural conditions of this country it would not be possible to found a profitable industry on the employment of potatoes as a material for distillation."

Briefly, it would appear that potatoes have a greater value as a food in this country than as a source of ethyl alcohol.

The question of producing cheap potato spirit in Germany is not always clearly understood. In Germany it is an agrarian question, one of political economy. There they have large tracts of land capable of being used for the cultivation of potatoes, but suitable for no other purposes.

These conditions being realized by the German government, and with the main idea of populating these inhospitable lands, and creating a reserve food supply, the industry was encouraged and subsidized. Rebates were fixed so that the distiller would be compelled to use potatoes as his source of alcohol rather than maize or molasses, which are subject to a heavy duty. In a word, the object of the German government was with a food supply in view, and alcohol was a natural outlet for the surplus crops. In many cases the potato spirit is sold at below cost price.

Maize or grain was also thoroughly examined by the Industrial Alcohol Committee, 1905. Quoting from evidence given here, "If potatoes were cheaper than maize, we should use them. But, in the first place, potatoes contain a very much smaller percentage of starch than maize, there being something like 20 per cent in potatoes and 60 per cent in maize. The cost of preparing for brewing potatoes containing so much less starch would be, in proportion, a good deal higher than the cost of brewing from maize."

It is apparently a fallacy to suppose that potatoes are a cheaper material than either maize or any other cereal. The price of potatoes varies tremendously. It has been suggested that potatoes would have to be well under £1 a ton to make it worth while. Potatoes to-day are 85s. to 40s. per ton.

Maize can be bought at about £5 a ton, and it should yield about three times as much alcohol as potatoes. Comparing potatoes and maize, the evidence is strongly in favor of the latter.

Prior to 1870 thirteen beet distilleries in Great Britain all came to grief. It has been suggested that the beets rotted before they could be distilled, and that the existing excise restrictions hampered the industry. Beet as a source of alcohol was discussed in a very valuable paper by Mr W. C. Easdale before the Royal Society of Arts last February, during the discussion on Dr. Ormandy's paper on "Alcohol as a Motor Fuel." It was suggested at this meeting that the sugar obtained from a given area of ground was of three times the value of the alcohol produced from it. Also the ultimate cost of the alcohol appears too high from this source. The yield was reckoned at twenty gallons of alcohol per ton of beet; one ton of beet being worth, as beet, about 21s. According to Mr. Easdale, one acre of sugar beet, at fifteen tons of beet to the acre, should produce about 300 gallons of alcohol. The cost of cultivation, including rent, carriage, and all expenses, is about £10 per acre. If one acre, at a cost of £10, produces material for 300 gallons of alcohol, the material alone for one gallon of alcohol will cost 8d. It seems that a cheaper material will have to be found.

Peat is a material with which I have had first-hand experience as a possible source of alcohol. There have been many unguarded statements regarding this material. Although ethyl alcohol can undoubtedly be manufactured from peat, it appears impracticable to produce on a commercial scale.

A series of exhaustive experiments over a long period revealed that only about nine proof gallons of alcohol were yielded per ton of peat and at a prohibitive price.

The *modus operandi* is the well-known one of the conversion of the cellulose into sugar by heat and pressure in the presence of an acid, this sugar being ultimately fermented and distilled. The three chief stumbling blocks are, first, that only the top fibrous layers of the peat bog contain convertible cellulose, the lower layers being too decomposed to admit of conversion; second, the large quantity of water present in all peat; third, the expense of draining, collecting, and delivering to factory.

One of the most promising sources of alcohol is wood sawdust or shavings, which is in many cases a waste material. The outcome of many experiments has proved that this process properly handled can be made successful in London or other large ports.

Besides yielding some thirty proof gallons of alcohol per ton of wood shavings or sawdust, there are also several other valuable by-products which occur in the process of manufacture which are a considerable set-off to the cost price of the alcohol.

This ethyl alcohol from wood can be made absolutely pure; at a low price, and identical with any grain spirit. It would insure a home supply in time of war for the alcohol needed for the manufacture of explosives.

To summarize the relative position of the possible sources of cheap industrial alcohol, the position of importance would appear to be occupied by colonial-grown maize, followed by wood sawdust as a source for home manufacture.

With the present information available, neither potatoes, beet, nor peat appear as favorable as is generally supposed.

Alcohol mixed with benzole, half and half, has long been known to give satisfactory results in ordinary gasoline engines with but little alteration. In Germany there are many agricultural engines working perfectly with alcohol alone.—*The Daily Telegraph.*

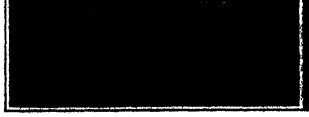


FIG. 6.—Spreading the bitumen and asphalt.



FIG. 7.—Tamping the sides of the reservoir.



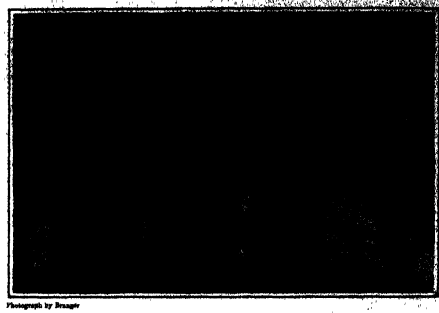
FIG 8.—Melting the bitumen and asphalt.

How water supplies are provided in a waterless country.



Photograph by Meurisse.

Placing the wounded in a motor ambulance. Note the two tiers of litters.



Photograph by Branger

A wounded man carried on mule back to the ambulance station.

Letters from the Firing Line

The Care of the Wounded

By Aide-de-Camp Xavier Sager, Special Correspondent of the SCIENTIFIC AMERICAN at the Front

THE war makes more victims than the most frightful epidemics, and its victims are not selected impartially among the young and the old, the men and the women, but they are taken mostly from the healthy young men whose life is full of promise—the flower of European male youth. We all know that in order to strengthen the ranks of the permanent army all the robust young men of the country are first picked out, while the sickly and the weak, those affected with corporeal blemishes, are refused.

For this reason, and even before the first shot is fired, the "war wounded" become the object of the solicitude of the board of health. The sanitary organization of the army is far from being the least care of its chiefs. This includes the search for the wounded on the field, their first care, their transportation, and their hospitalisation until they are entirely recovered.

The competent service of the army has been somewhat taken aback by the unexpected magnitude of its task. The war of 1914 is the conflict of a whole hemisphere. Indeed we do not lack well-equipped ambulances; our hospitals are up-to-date; our medical corps is competent; our nurses, men and women, are well trained and devoted to their task; and yet, in the gigantic clash of the armies, it often happens that some wounded soldiers are left too long lying where they have fallen. The fate of the wounded soldier does not depend on his wound only, but also on the place, and the time when he has fallen. Some men have the chance to be carried to the ambulance right after being shot, and others have to lie for hours helpless on the field, because either they are hidden in the brush or the spot where they have fallen cannot be reached without greatly endangering the life of the courageous stretcher bearers.

In some instances, as luck will have it, a man will be shot through and through, the wound inflicted will give the victim the minimum of suffering, and he will be up in an amazingly short time; in other instances a shell will mutilate a man so terribly that he will lie for weeks without hope and tortured by unendurable sufferings. Perhaps the unfortunate will live, so masterful is the power of his vital energy; but usually the chances of recovery depend on the promptness of the first aid. Too often, alas, the wounded lie on the field for hours which weigh on them like an eternity.

The vital importance of the military operations has frequently kept the ambulance corps away from a field on which the rain of shells and shrapnel was so murderous that the most elementary feeling of humanity forbid the exposure of the ambulance.

When a man has been shot in the leg or in the arm he is of no more use for the actual army, and for this reason he must be taken care of and gotten well in the shortest period of time possible—not only for humanity's sake, but also because he is a needed unit in the effective army.

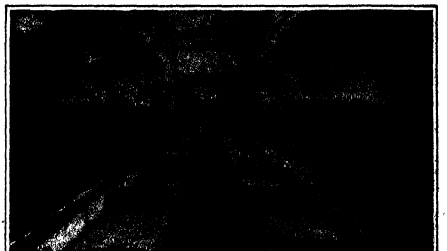
The individual first aid treatment, which is a comparatively recent practice, has been found very efficacious. In many cases the soldiers, helped by comrades, have been able to treat their wounds to avoid any dangerous contamination before reaching the ambulance.

The *morale* of the wounded soldiers is excellent. Their smartness is always equal to the circumstances, and even in the most tragic moments they find a way out of their predicament. Here is a characteristic example: I am right now near a trooper; his hip has been shattered by shrapnel, and before he was picked up he had lain for 24 hours on the damp ground of a marsh. I asked him what he did when he felt he had been struck. "When I realized I could not even crawl," he said, "I took out my individual medicine case; after I had dressed my wounds as well as I could I got hold of a piece of cord, which I had saved for this special purpose, and I tied it as tight as possible around my leg in order to stop the loss of blood. Then I put my knapsack under my head, and I placed in reach of my hand my provision of canned meat, a few pears, and a bottle of water. I waited patiently for help, and kept eating my provisions that I might retain my strength. Every ten minutes I screamed: *à moi, à moi!* (Help, help). Suddenly I lost consciousness; the world seemed to vanish. When I woke up it was night and chilly. I heard the sad voices of wounded soldiers asking 'a drink, a drink.' I heard a man, who from the hole where he had fallen, was advising a comrade: 'hide yourself, the Germans are coming; make believe you are dead!' I tried to move my leg that the horrible pain might, once more, make me lose the notion of things. Later on a clamor dragged me out of my unconsciousness. The light of a lantern was on my face, and I heard a voice saying: 'Where are you wounded? *pauvre petit!*' Somebody cut my trousers, which the blood had stiffened to a cardboard. Then came to my nostrils the horrible odor of the corpses heaped up all around me. I was so glad to be alive that I laughed for sheer joy of it, and soon I felt the pure water of France moistening my dry throat. . . ."



Photograph by Paul Thompson.

A Red Cross dog discovering a wounded man.



Copyright by Underwood & Underwood.

Interior of an English military ambulance train.

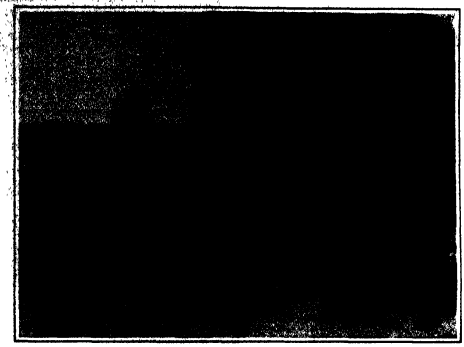
As soon as a fallen soldier is found a surgeon dresses his wounds. He is given a drink and hauled on a small two-wheeled carriage of the ambulance service. This carriage, pulled by two *brancardiers*, makes at once for the nearest ambulance station. When the army ambulance has been reached the wounds of the soldier are given a thorough examination. The men seriously wounded, demanding a surgical operation, are operated upon on the spot.

The war surgery in the army hospitals requires first-class doctors. The results obtained so far have been very encouraging, and the percentage of mortality would be exceedingly small if complications of gangrene and tetanus did not set in. To stop gangrene, injections of oxygenated water have been found preferable to amputation or large incisions; but, of course, this is only a preliminary emergency treatment. The tetanus bacilli are found in the layers of the surface of the earth, in the dust, in the slime, and especially in the ground where horses and cattle have herded, the excrement of horses being particularly fertile in this bacillus. In time of peace precautions

(Concluded on page 514.)



Portable telephone outfit. The wire carried on the back.



A field telephone station of the German Army of the West connecting it with the commander of the corps.



Lighter portable outfit. The wire carried on a hand reel.

The German Military Telephone System

By H. Marchand

AMONG the apparatus which the German army has specially studied we may note the various appliances of telephony for communication between patrols and the main body, between troops in charge of the railway service, and between the signal corps of the army.

The properties of telephony which make it of great importance for military use, are its simplicity and the high speed of communication it affords. The growing number of soldiers engaged in battles and the wide dispersion of the various corps on areas more and more extended, make it absolutely necessary that the signal corps possess means of prompt and sure communication. While radio-telegraphy, as well as wire telegraphy, may be of value for long distance communication, the telephone is essential for short distance communication with a minimum of delay and a maximum of clearness.

The German army uses four principal types of apparatus. The first is a light equipment with a high-frequency vibratory device used for the calling signals and for communication by Morse signals. This apparatus is used by patrols, the signal corps, and the field artillery. The second type of apparatus employs a magneto coil, and this is used for railway troops.

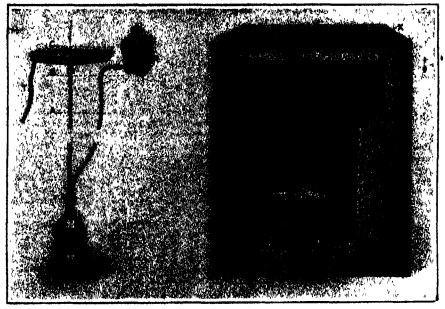
The third type is a combination of the first two, and is used for communication between corps; while the fourth is a loud-speaking telephone apparatus. The high-frequency vibrator is arranged to be connected with telegraph lines without interfering with the telegraph signals. Each post is fitted with the necessary source of power and a length of flexible cable. In the lighter, portable apparatus the line of insulated wire is carried on light reels which may readily be transported by the men in the manner shown in the photographs. The heavier apparatus with its coil of cable used for the signal corps is carried on light trucks. The lines are laid on the ground or on poles, trees, etc., or in dry trenches. Field stations are connected with the existing telegraph or telephone circuits. When desired, as, for instance, for the military railway troops, special permanent lines of bronze wire are installed.

Bending Bows for Vehicle Tops

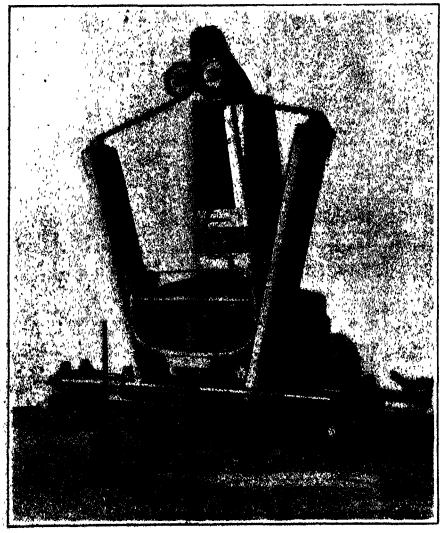
A MACHINE for bending the bows of automobile, carriage, and wagon tops is here illustrated. It will take bows varying from 36 to 72 inches between bends.

Cast iron forms are used, and they are galvanized to prevent corrosion of the stock. The forms are adjustable by means of a right and left hand screw for bending the different widths of bows which come within the limits of the machine. They are raised and lowered by power and rest firmly on top of the material.

The bending arms, which occupy a horizontal position before the bending begins, which receives the material to be bent are fitted with a steel band or master strap over the entire upper surface, forming a table to support the minor strap



Models illustrating the action of geysers and hot springs.
At the left is shown Wiedemann's artificial geyser. On the right is the improved Merrill apparatus that shows what takes place in the Yellowstone Park region.



A machine for bending the bows of vehicle tops.

The minor straps are fitted with malleable iron end castings with screw adjustment for placing the end pressure on the stock. The arms are operated by means of link cable chain, in connection with a cast iron drum driven by a suitable gearing.

A convenient hand lever is used for starting and stopping the machine at the beginning and the end of the bending operation. After the arms are returned to their original position, the drum is automatically stopped. Four large steel springs are employed for holding the material firmly against the forms during the course of bending, to insure perfectly true circles, and special provision is made for taking care of the stretch of the master strap.

After the bend is completed, a malleable iron shackle is used to connect the ends of the minor strap, so as to hold the bent stock in its true shape after being removed from the machine. By one full turn of the right and left hand screw, the forms are moved inward to release the stock for easy removal. The stock remains in the minor strap until thoroughly cooled and set.

Artificial Geysers

D. L. MERRILL of Battle Creek, Mich., sends the accompanying sketch of apparatus that he has constructed to illustrate the action of the geysers and hot springs of Yellowstone Park.

A galvanized iron tank of water, *X*, 18 by 24 inches and 4 inches deep, represents the Yellowstone Lake. It is supported by a wooden cabinet with doors, and a shelf holding a gas stove (11), representing the hot rock underlying the valley. No. 10 is a copper vessel that represents a reservoir deep down in the earth, near the source of heat. The rubber and copper tubing are ⅜ inch in diameter. Nos. 8 and 9 are drain pipes for draining the lake to the heated subterranean reservoir. No. 7 is the fissure leading down from the lake to the heated subterranean reservoir. No. 6 is a pipe which gives Old Faithful. This explodes every seven minutes, throwing water and steam over four feet high. (The original Old Faithful is in eruption every 60 to 75 minutes, and throws the water 125 to 150 feet high.) No. 5 is the Bee Hive, irregular in its action. (The eruptions of the original occur at intervals of from seven to nine days.) No. 4 is the Riverside Geyser, while Nos. 2 and 3 are just hot springs, though all three are branches of a single tube. Mr. Merrill says: "I found that lengthening and shortening any one of my tubes changed its action."

This is but one of the many pieces of apparatus which have been made by various people to illustrate and help explain the action of geysers, but it differs from all others of which we have any knowledge in showing several different forms of

(Concluded on page 516.)

Inventions New and Interesting

Simple Patent Law: Patent Office News: Notes on Trademarks

Sorting Out Frosted Oranges and Lemons

By Shelby McKinstry

THE way to determine whether a lemon or an orange is frosted or frozen is to cut it in two and look at the juice globules. The outside of the fruit bears no trace of injury from cold. But the grower cannot afford to cut every fruit. Fortunately, there is a very simple separator, the invention of Frank Chase, a California orange grower, with which the injured fruit may readily be sorted out from the sound specimens. The device consists of a long trough containing water. At one end is a feeder board on which the boxes of fruit are dumped and from which the fruit is carried by a cleated conveyor. The conveyor carries the fruit to the edge of the board, whence they tumble into the water. The purpose of the conveyor is to bring the fruit to the water in an orderly way, so that they will not fall into it in heaps.

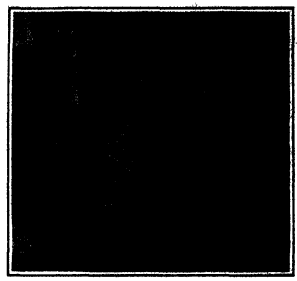
Frosted or *frozen* oranges and lemons are lighter than sound fruit. The more badly they have been injured by the frost the lighter they become. Hence, by passing them through water their specific gravity may be determined very readily. When they drop into the water, the sound fruit sinks to the bottom, while the frosted fruit bobs up to the surface and floats. The slightly injured fruit is only barely submerged. The water in the trough is kept moving toward a chute, where the fruit is caught by screens adjusted to the desired depth in the trough. With this simple water separator five grades of fruit may be separated at a single operation.

Before the separator was invented, the citrus growers of the country lost millions of dollars' worth of fruit on account of frost. The water separator came into use in the spring of 1913, after one of the coldest spells the citrus industry of California had ever experienced, and although much of the citrus crop had already been thrown away, this separator saved, it is estimated, more than half a million dollars' worth of splendid fruit, and perhaps two thirds of the crop could have been saved had it come earlier; for it is now positively known that hundreds of thousands of dollars' worth of oranges and lemons were thrown away, simply because the growers could not sort out the good from the damaged product and supposed that all had been injured.

Digging and Filling Trenches by Machine

SOME examples of the interesting machinery now used for digging ditches, filling them, and tamping them after they have been filled, are shown in the accompanying engravings. They have been used very effectively in the laying of water, gas and sewer pipes, and also in refinishing roads and street pavements, after an excavation has been made in them.

The digging machine we show has an excavating wheel consisting of a large internal gear wheel driven by a pinion and bearing on its outer surface a series of buckets. As these are carried around by the wheel they bite into the earth, picking up a load which they carry around and discharge at the top of their course upon a belt conveyor. The latter carries the excavated material to one side. The belt conveyor is arranged to pass through the excavating wheel to deliver to the opposite side if so desired. The excavating wheel may be raised and lowered to cut a trench varying in depth from 4½ to 12 feet, while the width of cut may range from 11½ to 54 inches. The rate of forward speed of the machine varies with different conditions between 1⅔ and 5½ feet per minute. The machine may transport itself to the scene of operation, and it travels on the road with a speed of a mile and a quarter per hour. These excavating machines are arranged to be operated either by steam or internal combustion engine. The



Machine for sorting out frosted oranges and lemons.

one shown in our engraving is driven by a gasoline engine.

The method of filling the trench after the pipe has been laid is shown in another photograph. A scoop is arranged to run horizontally, dragging the earth from the sides of the trench into the excavation. After the trench has been filled the loose earth may be tamped down by a third machine. This machine has a vertical beam fitted with a tamping shoe at the lower end, which reciprocates vertically, pounding down the earth and tamping it compactly.



Tamping the earth after the trench has been filled.

The Building of Bird Houses

RECOGNIZING the universal interest in our feathered friends, the Department of Agriculture has issued what promises to be a very useful Farmers' Bulletin No. 609 by the Assistant Biologist, Ned Dearborne, on "Bird Houses and How to Build Them." It is clearly written, well illustrated, and ranges from the utilization of tomato cans and gourds in various ways to the working plans and specifications of more ambitious houses, some on the apartment plan, to satisfy the social instinct so marked in martins, but so conspicuously lacking in most other birds. The bulletin is sure to find favor with those having a special interest in the subject, including, as it does, not only the houses, but chapters on the care of the houses, the enemies of house birds, and food shelters.

Amendment to Patent Office Rules

THE Patent Office has made another effort to aid inventors in securing foreign patents during the disturbed conditions abroad by amending, with the approval of the Secretary of the Interior, Rule 165, by adding thereto a provision, as follows:

"In view of the conditions arising from the European war, the provision that an application will not be withdrawn from issue after the case has received its date and number 'for the purpose of enabling the inventor to procure a foreign patent' will not be insisted upon, and upon a proper showing such an application may be withdrawn from issue until the foreign applications can be filed.

"This amendment of the rule will be in force for one year from date of its approval by the Secretary of the Interior."

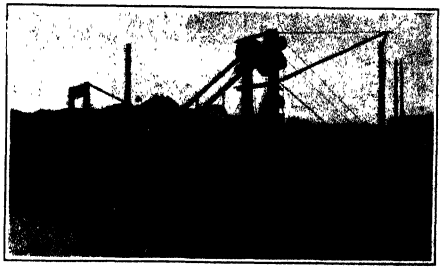
Equalizing the Force of Assistant Examiners

HOUSE Bill 18031, which has passed the House and been introduced in the Senate, provides for eighty-six assistant examiners in each of the four assistant grades, increasing the numbers in the high grades and decreasing the number of fourth assistants, calling for the promotion of many fourth assistants, the number of which at present is about one hundred and forty, so that the excess over eighty-six, amounting to fifty-four, will be promoted when the bill becomes a law, numerous promotions also occurring in the higher grades.

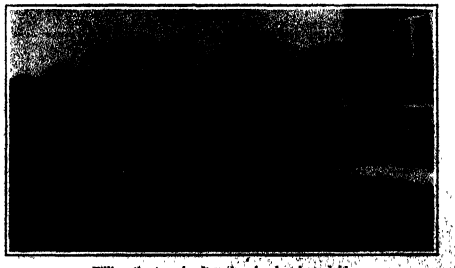
The enactment is important not only in increasing the number of high grade assistants, but also in the encouragement to those in the lower grades because of the increased prospects of promotion.

A German Steam Engine Plant

THE Deutsche Waffen und Munitions-Fabriken, which is one of the leading arms and ammunition works in Germany, has recently erected four steam engines of the new Lans "demi-stationary" type. These engines resemble the locomobile makeup except that they are not mounted on wheels, and are, in fact, employed as stationary engines. The engine is mounted permanently on top of the boiler, forming a single unit. For the larger sizes, such as the above, a flooring is run across the engine room so that the dynamos can be mounted directly upon the engine shaft. The present engines are of 370 and 580 horse-power sizes, and give a total of 2,350 horse-power.



Digging a trench for a pipe line.



Filling the trench after the pipe has been laid.

RECENTLY PATENTED INVENTIONS

Interesting Devices Described Briefly

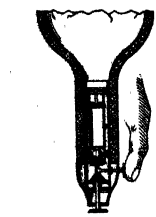
These columns are open to all patentees. The editors are inundated by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of Interest to Farmers.

GRAIN TREATING MACHINE.—C. C. Conway and L. E. Wenck, Munich, N. D. In this case the object of the inventor is to provide a cleaning machine especially designed for treating seed grain, and wherein there is provided a conveyor for conveying the grain through a cleansing solution to thoroughly clean the grain.

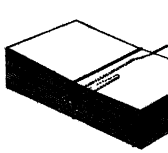
Of General Interest.

NON REFILLABLE BOTTLE.—P. Bornman, 217 Atlantic Ave., Station A, Algiers, La. This device has a gravity valve and a manually actuable valve adapted to coact in allowing the contents of a bottle to be poured out when the bottle is inverted, but prevents refilling of the bottle when the same is in upright position, the gravity actuable valve adapted to close automatically to prevent refilling, irrespective of the position of the manually actuable valve.



NON REFILLABLE BOTTLE.

PACKAGE FASTENER.—H. F. Molkenbur, 337 Forest St., St. Paul, Minn. This invention relates to ties for holding a number of articles together, such as envelops, files and the like, and the main object thereof is to provide such means which render the packaging operation very quick and secure, as also the untying thereof, which dispense with the necessity for knots in the twine or cord, and which employ the articles bound into a package for the twine securing means.



PACKAGE FASTENER.

CAMERA SHUTTER.—J. A. Duncan, Jr., St. Joseph, Mo. This invention refers to camera shutters, and is particularly directed to improvements whereby pictures may be taken in the shortest possible space of time, the construction being such that a maximum of light in a given interval is admitted to the camera.

FIRE ESCAPE.—M. J. Fitzgerald, 6155 Romaine Ave., Los Angeles, Cal. The invention relates particularly to a ladder normally supported above the first balcony and adapted to be lowered to the street in an emergency. It provides guides in the first and second balconies in which the ladder has movement, and a novel device on one balcony which will hold the ladder in the raised position above the first balcony, the device being readily movable to release the ladder and permit it to be lowered.

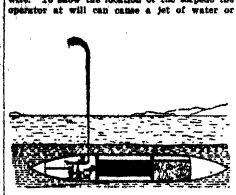
Household Utilities.

WINDOW SASH AND FRAME.—J. F. Armstrong, 1087 Park Ave., New York, N. Y. The invention provides means whereby the sashes may be reversed to present both surfaces of the same to the interior of a room; provides a construction to accomplish the above-stated purpose; provides a form of weather stripping for the structure; and provides devices from the inside of the building only for releasing the swinging structure.

Machines and Mechanical Devices.

REMOVING ATTACHMENT FOR REWING MACHINES.—W. Nicholson, care of Hennessy Supplement Co., 17 Battery St., San Francisco, Cal. The attachment is arranged to permit of opening the scroll for conveniently removing the work when desired by the operator. To accomplish the desired result, use is made of a scroll divided in the direction of its length to form two scroll sections, and means for moving the sections one relative to the other to open or close the scroll.

DIRIGIBLE SUBMARINE TORPEDO.—G. F. Hendrick, 976 Fox Street, Bronx, N. Y., N. Y. This torpedo is electrically propelled and maneuvered by means of a single insulated wire. To show the location of the torpedo the operator at will can cause a jet of water or



DIRIGIBLE SUBMARINE TORPEDO.

a beam of light to be thrown up from the torpedo to a considerable height above the surface, and these markers cannot be destroyed by gunfire. A depth regulator automatically keeps the torpedo at a given depth below the surface, irrespective of the weight of the torpedo.

SLUICE BOX.—H. W. Fry. Address G. T. Holley, attorney, 335 F St., Eureka, Cal. The more particular purpose here is to produce a sluice box provided with means for conferring upon it a peculiar rocking motion which is very effective for separating the fines from broken or granular material, such as gold bearing sand, and crushed quarts.

TELESCOPE MOUNTING FOR FIREARMS.—E. P. Camus, 1136 E. 8th St., Brooklyn, N. Y., N. Y. This inventor provides an adjustable mounting which can be easily and quickly connected or dismounted from the member carrying the mounting without any tool, which connection is not affected by the vibration set up by the discharge of the firearm, and which mounting affords a perfect lateral adjustment of the telescope thereon without any additional support for the telescope on the means carrying the same.

MEASURING PUMP.—W. H. Ward, 11½ Green St., Cumberland, Md. This invention provides a pump of the reciprocating type, the piston rod of which has means adapted to engage indicating means carried by an arm associated with the cylinder whereby different quantities of liquid can be made to be delivered by the pump

GRIZZLY.—E. W. Paget, care Nathan I. Raber, 121 N. 8th St., Corvallis, Ore. The invention relates to a grate structure, known under the name of "Grizzly" in the mining industry; and the object thereof is to provide an efficient grizzly in which the gap between the grizzly bars is adjustable, and which gap is adapted to create a suction on the fluid flowing over the said grizzly.

Pertaining to Music.

VIOLIN PIANO.—F. H. Watson, Jonesboro, Ark. This violin piano is arranged to permit either the violin or the piano or both to be played at the same time with the same keys, and to insure a proper contact between the broad surfaces of the sadiron traveling bands and the vibrating piano strings with a view to produce full and clear violin sounds.

Prime Movers and Their Accessories.

LUBRICATOR FEED.—W. H. Holtby, Martha, Okla. This invention provides means for feeding a lubricant to a crank-case of an internal combustion engine, the construction being such that the lubricant will be maintained at a pre-determined level in the crank-case and the feed will be positive even when the engine is running at a high rate of speed and the lubricant in the crankcase is churned by the crank.

STEAM TURBINE.—T. Rigby, Kelton House, Dumfries, Scotland. This invention relates to steam power installations, and has for its object to enable economies to be effected in the operation thereof by the employment in a particular manner in heating devices of steam which has already performed work in the prime mover.

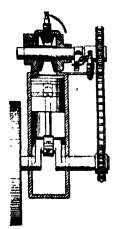
INTERNAL COMBUSTION MOTOR.—A. L. Clayes, 461 Hamilton Ave., Detroit, Mich. The object here is to provide a motor preferably of the two-cycle type, which is designed to afford efficient and prompt and complete admission of the fuel charge when the piston is about at the end of its out stroke, together with a thorough cooling of all of the working parts of the engine when the same is in operation.

OSCILLATING ENGINE AND SELF REGULATING GEAR THEREFOR.—J. Bengesen, 261 E. 31st St., Brooklyn, N. Y., N. Y. This invention relates particularly to engines of the oscillating type, and also to the valve gear designed to properly control the same. It provides an engine of the oscillating type with a plurality of pistons and suitable valve gearing, so that a maximum power may be provided in a minimum space and at a minimum cost.

REVERSING ENGINE.—J. Bengesen, 261 E. 31st St., Brooklyn, N. Y., N. Y. The present invention is designed to present an improved structure over Mr. Bergesen's former patent No. 821,398. The object is to provide a simplified structure wherein a slight movement of the valve mechanism will readily move the piston in either direction.

VALVE FOR INTERNAL COMBUSTION ENGINES.—C. W. Fowler, Lyndon, Ky. The purpose here is to produce a construction which can be applied to almost any gas engine without the necessity of remodeling the same, and which will be perfectly easy and noiseless in operation and free from the other defects of the poppet valve type, and in which quick opening and closing of the ports are secured, owing to the long, narrow ports permissible in this type of valve

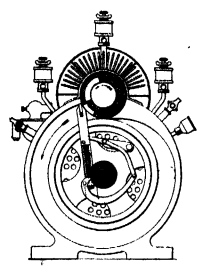
GAS ENGINE VALVE.—G. W. Crawford, Route 3, Fremont, Mich. In the present patent the invention has reference to valves particularly adapted for use in connection with gas engines, the inventor's object being the provision



GAS ENGINE VALVE

of a rotary valve of novel construction, whereby it will be self-balancing and self-grinding. The accompanying engraving illustrates a vertical longitudinal section through the gas engine provided with an improved rotary valve

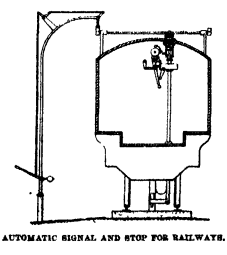
INTERNAL COMBUSTION ENGINE.—H. F. Neumeyer, Macungie, Pa. This inventor provides an engine having means for successively compressing, heating, exploding, and delivering the explosive fuel and expansive gases thereof, provides a system for cooling by air the operative parts of the engine, provides a system of packing the joints of the moving and stationary parts of the engine; provides a simplified and efficient turning mechanism, and provides a simple and efficient valve and operating mechanism therefor



INTERNAL COMBUSTION ENGINE.

Railways and Their Accessories.

AUTOMATIC SIGNAL AND STOP FOR RAILWAYS.—L. C. Krummel, 488 Nostrand Ave., Brooklyn, N. Y., N. Y. In this case an object is to provide an improved structure which will signal the engineer under certain circumstances, and will automatically stop the train unless positively held in an inoperative position by the engineer. Means are provided whereby the engineer will have absolute control over the engine at all times, but when negligent or incapacitated for any reason, the mechanism will automatically operate



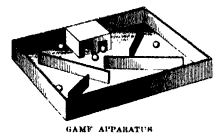
AUTOMATIC SIGNAL AND STOP FOR RAILWAYS.

BUILDING.—A. Brown, Plainfield, Ill. Mr. Brown's invention has reference to buildings of a type suitable for use in connection with railways, and employed more especially for the purpose of enabling sweepers or other vehicles to discharge refuse directly into cars standing upon railway tracks

BRAKE SHOE.—L. E. Hinkley, Millersburg, Ohio In the present case the invention relates to the wearing blocks or shoes used upon railway brakes, and its object is to provide certain improvements in brake shoes whereby the steel back and the cast iron body are fused together at all points of contact to prevent the parts from becoming separated when the brake shoe is in use.

Pertaining to Recreation.

GAME APPARATUS.—Johanna L. Ryan, care of C. A. Thurow, 209 S. Clinton Ave., Rochester, N. Y. This invention has for its object to provide a game apparatus having a board with a side wall thereabout, there being



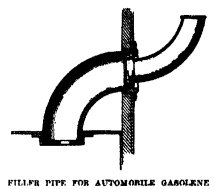
GAME APPARATUS

at one side of the board an inclosure with two openings into which a player may roll a number of marbles Means are provided to act as guides and obstructions in rolling the marbles into the openings in the inclosure

TOY.—A. I. Orlansky, 44 Morris St., Charleston, S. C. In the present patent the invention has reference to improvements in toys, and more particularly to a game device for playing novel and amusing games requiring the exercise of skill and proving an amusement to old as well as to young folk.

Pertaining to Vehicles.

FILLER PIPE FOR AUTOMOBILE GASOLINE TANKS.—W. W. Wood, Jr., Huntington, N. Y. The invention provides a telescoping pipe structure associated with the tanks of automobiles and the like which may be moved outwardly for providing a spout or filling



FILLER PIPE FOR AUTOMOBILE GASOLENE TANKS.

members, and moved inwardly out of the way when not in use It provides a telescoping filling member for automobile tanks which is adapted to extend outwardly from the side so that the seat of the automobile need not be collapsed during the filling operation.

SHOCK ABSORBER FOR VEHICLES.—W. J. Faber, care of Christian C. Faber, 1821 Brooklyn Ave., Brooklyn, N. Y., N. Y. The invention relates to motor vehicles or the like having peculiarly formed spindles or axles whereby the impact upon the wheel is to a large extent absorbed by a spring controlled member between the wheel and the main axle in a peculiar manner.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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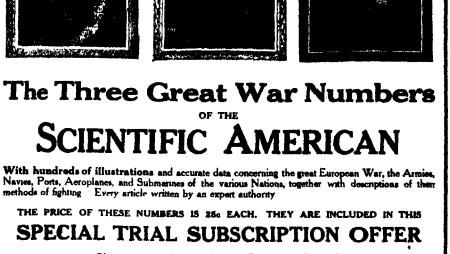
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Letters from the Firing Line

(Continued from page 510.)

can be taken; but in war time it becomes impossible to take sanitary precautions toward that end, and the soldiers having to dig trenches—miles after miles—in the ground upon which thousands of horses have passed, bring to the surface myriads of germs, which otherwise would have remained undisturbed and almost harmless; and this is why, to the great astonishment and sorrow of the French and English doctors, the cases of tetanus seem to be more numerous and more severe here than in the Transvaal and in Morocco, where the soil is still virgin and relatively aseptic. At the first symptom of tetanus, the soldier is treated with injections of anti-tetanus serum, while on another part injections of sulphate of magnesia stop the contractions and relieve the patient. Unfortunately, the number of deaths due to tetanus is very great. Lately each soldier has been given a small vial containing ten cubic centimeters of anti-tetanus serum and a syringe with a sterilized needle. When the soldier falls on the battlefield, if he is able to practice on himself the serum injection he does not wait passively the arrival of the doctor, but he acts at once, and uses the needle. In two minutes the injection is made. If the soldier is unable to do it himself a comrade renders him this service.

As soon as the men have been taken care of and their wounds dressed it is necessary to send them as far as possible from the war zone. The hospitals of the second line, called hospitals of evacuation, must be constantly relieved, and only the soldiers whose lives might be endangered by transportation remain there. These hospitals, situated only 30 or 40 kilometers away from the firing line, are far from being a restful and quiet shelter. If the army is compelled to retreat they become directly menaced and are liable to fall, with their wounded, into the hands of the enemy. The evacuation for a short distance has the same inconveniences; for, if the army operated in a folding movement, the hospitals of second line, which then would become hospitals of evacuation, could not be utilized in this manner, being already crowded. Therefore, it is necessary to keep the territory free behind the armies and to send the wounded soldiers to places which in no way can be menaced by invasion.

Let us pass now to the question of transportation. As the sanitary organization has not at its disposal the many thousands of automobiles which would be necessary to the transportation of the wounded in the south of France, the railroads are used for that purpose. Here the sanitary organization does not organize, but utilizes for the best the material in its hands.

The sanitary trains are composed of a certain number of cars varying between 40 and 60 of the French size. The men severely wounded are placed in the first and second class compartments, two men to a compartment, while the soldiers who are able to sit occupy the third class. A few freight cars have been fitted with spring suspended litters, reserved for the men whose lower part of the body is in splints. The German wounded are isolated and under guard. Such a train differs greatly from the model train ambulance, sanitary and comfortable, with dispensary and a corridor running from one end of the convoy to the other. Such trains, however, are scarce and rarely seen save in the universal exhibitions.

Last week I saw a train given and fitted up by a rich woman whose sympathetic heart had been moved at the conditions in which our wounded soldiers had to travel. This train was composed of twelve freight cars, the inside of each one being coated with a washable composition. The floors were covered with linoleum, and the sides were upholstered up to a certain height. If the outside was not luxurious, the inside was very comfortable.

It is pretty safe to say that this train will not come a second time to the firing line. Why? Simply because in war time there is one thing which is importance

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FOR SALE. Patent 1,104,103. Improved Switchboard Plug, "means better telephone service." Will sell outright. Full particulars address D. Swan & Company, Washington, D. C.

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Inquiry No. 9402. Wanted the name and address of a manufacturer who can make a tin toy.

Inquiry No. 9403. Wanted the name and address of a glass manufacturer who can blow a small glass article to order.

Inquiry No. 9404. Wanted the name and address of a manufacturer of a tool for cutting slots in plate glass used for name plates and house numbers.

Inquiry No. 9405. Wanted the name and address of a manufacturer who is able to supply an attachment system, aluminum or celluloid through which a message may be sent.

Inquiry No. 9406. Wanted the name and address of a manufacturer who can supply the material in rolls for the special purpose to dump leather compressed and attached to a canvas bottom.

Inquiry No. 9407. Wanted the name and address of some patented mechanical device which saves time in the use of both hands. Supply handled will bring a large demand. It must not be too expensive. It may be electrical as well as mechanical. A first class article desired.

Inquiry No. 9408. Wanted the name and address of a manufacturer or dealer in supplies of a machine will stamp both single and double lacing tags; capacity about 1,000 per hour.

Inquiry No. 9409. Wanted to secure a patented device which can be manufactured for about 25 cents and sold for $1.00. Must be simple to build.

Inquiry No. 9410. Wanted the name and address of manufacturers of Pebble Shoes.

Inquiry No. 9411. Wanted the name and address of a firm that is doing automatic screw machine work between 1/8 inch and 1/4 inch.

Inquiry No. 9412. Wanted the name and address of a manufacturer of a machine for making artificial tobacco ribbons for cigarettes.

Inquiry No. 9413. Wanted the name and address of a metal founder who can make a small brass gong. Diameter not more than 6 inches and depth not more than 2 inches.

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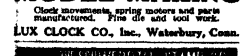
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surpasses all else: the supply of the army. When every day it is necessary to send by rail hundreds of trains carrying war material, ammunition and the food, it is difficult to reserve time in the schedule for the sanitary trains. However, when unloaded, these convoys of supply have to be sent back, and, instead of returning them empty, they are used as a means of transportation for the wounded soldiers. It is true that the hygienic conditions are far from being perfect, but still it is better to send the men back in these uncomfortable cars than to overcrowd the hospitals.

Here is the remote station where the freight train has just stopped, bringing 500 young men back from the front. Their blue and scarlet uniforms are covered with mud. For four days their broken legs and arms, all their shattered bones and torn flesh have been painfully shaken in transit. One by one they are taken from the cars under direction of the surgeon who, during the trip, was in charge of their compartment. Here is a soldier whose face is entirely purple; the displacement of the air after the explosion of a shell made one big bruise of his face. His anxious eyes search the crowd, fearing a look of repulsion on other people's faces, but the crowd smile at him, young women look sweetly into his eyes, and his anxiety gradually disappears. The others, immobile on their litter, are waiting to be carried to the hospital, where good beds are ready for them. They are placed in automobiles by the doctors, some nurses accompanying them; a rumor of admiration passes through the crowd; the young heroes are hailed and acclaimed enthusiastically. Wrapped in their bandages they smile upon the cheering crowd. They are moved by this enthusiastic reception; those who can lift their *kepis* (caps) waved them, and wherever they pass on their way to the military hospital they are saluted with the same enthusiasm. The aim of their destination—a military hospital situated on the shores of the Mediterranean Sea, was, previous to the war, one of those palatial hotels destined to receive the millionaires of the two Americas. The six hundred heavy brass beds are waiting for the wounded heroes, who, for so long, have not known the comfort of a bed The lights of the hall are burning full blaze in their expensive chandeliers and throw a bright light on the *dames blanches* busily caring for the wounded soldiers. It is for these young men, mostly clerks, farm hands, or factory workers, a glorious moment when these admirable women, belonging to the aristocracy of the country, kneel at their side to dress their wounds.

A wounded soldier represents a particle of the national sacrifice; he is a hero in the eyes of the people. A merely sick soldier has not the same value, and unfortunately war also produces illness. The wounded are the first victims of the war; the sick soldiers only begin to appear in our lines of battle after a certain period marked by the using up of the forces, overwork, hardships, etc. From a certain aspect of war it is much better to be wounded than to be ill. I have seen soldiers stricken with dysentery; the general depression which weighs upon them renders their recovery much more difficult than that of the wounded.

The great majority of the soldiers are, fortunately, only slightly wounded; but the fact of being wounded does not kill their desire to go back to the front. At the beginning of the war the wounded were sent back to their families; but during their convalescence they were spoiled, and when they were sent back to the army the transition from the loving care of a home to the privations and terror of war was too much of a shock and too painful. Now the wounded and the sick stay in the hospital until they are sufficiently recovered to rejoin their regiments. Three months of experience have shown us that stoicism is essential for a people who would win.

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to have supplemented. There are millions of these noxious germs around the carcass and the remains of swollen and stiff animals.

Automobiles with the sign of the Blue Cross have lately made their appearance. They belong to the society for help to the wounded horses. The society picks up wounded and sick horses on the field and carries them to an ambulance station, where they are taken care of.

Artificial Geyser

(Concluded from page 511.)

geyser in operation at the same time. Müller's apparatus, which is described and figured in so many books (including the Encyclopedia Britannica, eleventh edition, under "Geyser") that no account of it need be given here, shows the operation of the "Old Faithful" type of geyser, according to Bunsen's well-known theory.

A less familiar device, described many years ago by Prof. G. Wiedemann of Leipzig, explains certain irregularities in the action of geysers. The accompanying diagram shows this device, as adapted by Prof. T. A. Jaggar, Jr., who originally proposed the experiments described below. Here we have a water-column, heated below, and a supply-tube entering this column and connecting it with a reservoir (*R*) of cooler superficial waters. The main geyser-tube is 4 feet long by ¼ inch outside diameter, and at the top of the tube is a basin 2 feet diameter. The most important feature of the apparatus is the fact that the reservoir (*R*) which feeds the geyser may be placed at any desired level, as *A*, *B*, or *C*. The supply tube is recurved slightly at the bottom of the flask, so that the cold jets that siphon in from the reservoir will not be directed against the glass wall of the flask and break it. The basin at the top of the main tube may be raised until the bottom is flush with the mouth of the tube.

In order to produce a regular periodic geyser of the "Old Faithful" type, the reservoir must be placed below the level of the top of the main tube, as at *A*. After heating for about fourteen minutes an eruption takes place, the water being ejected to a height of about four feet, followed by a mixture of water and steam. Then water feeds in from the reservoir, and further heating results in successive eruptions at intervals of about one and one half minutes, each eruption lasting about twenty seconds. The position of the basin may be adjusted so that the ejected water will or will not flow back in the tube, as desired; if it does so, the water in the reservoir grows warmer, and the eruptions occur more frequently.

Quite different phenomena are produced if the reservoir be placed at *C*, just above the mouth of the geyser tube. There will now be a continuous flow of hot water, and if the outlet tube *T* be left open and water be continuously supplied to the reservoir, the water in the flask will not reach the boiling point. We then have a hot spring instead of a geyser. At this stage let us stop supplying water to the reservoir until the water-level in the reservoir has fallen 6 inches below *C*, say to *B*. The spring continues to flow, on account of the expansion of the heated water in the geyser tube, and also on account of the convectional upflow, which acts as a driving power, even against a reversed head, after the flow has once been established. If, at this point, we lead the overflow tube *T* into the reservoir, we establish a permanent circulation, the only loss being by evaporation. Hydrothermal and hydrostatic forces are, however, in very delicate equilibrium. If the reservoir be lowered an inch, the overflow decreases, boiling takes place below, and a very violent eruption occurs. The same effect may be produced by placing the glass stopper in the reservoir bottle, and thus checking atmospheric pressure.

Prof. Jaggar's experiments show how comparatively slight changes in the head of water supplying the geyser—due, for example, to fluctuations in rainfall, building up a sinter cone at the orifice, clogging of old conduits, etc.—may turn a geyser into a hot spring, or *vice versa*, or cause irregularities in a geyser's eruption.



This judge has no arms

yet he can strike a match, dress himself, shave, and has driven a car 85,000 miles. He can do *without* arms almost anything that you can do *with* both of yours. And he is a county judge, besides. Interesting?

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AMERICAN MAGAZINE

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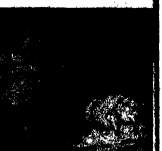
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SEVENTEENTH ANNUAL

Motor Number

OF THE

SCIENTIFIC AMERICAN

January 2, 1915

FOR a complete history of the automobile refer to the files of the Scientific American. The whole story is there from the birth of the motor-driven vehicle, long before the first automobile journal was published, down to the present day. Week by week the biography is written and annually there is a *resumé* of the year's developments. The seventeenth annual *resumé* will be found in the issue of January 2, 1915. The following are some of the subjects that will be taken up:

The Car of 1915. One might suppose that in all these years of development the automobile had reached a point where there would be practically no further growth. However, the new year ushers in some important innovations and a great many lesser improvements, which, slight as they may seem, make for greater comfort and convenience. They will be described fully and illustrated with sketches.

Military Tactics and the Motor. The absolute necessity of the motor car in modern warfare has been demonstrated in the present titanic struggle in Europe. A very comprehensive article has been prepared on the use of the motor vehicle, in transporting guns, ammunition, supplies and men, and in bearing the wounded to the rear.

How Small Communities May Have Good Roads. Never in the world's history have roads been subjected to such hard usage as in the present day, and never has the subject of road-building received so much scientific investigation. Yet out of two and a quarter million miles of public roads in this country, only a quarter of a million are improved with any form of surfacing. Evidently there is still a great deal of work to be done by rural communities. Logan Waller Page, Director of the Office of Public Roads, gives some valuable suggestions on co-operative undertakings that will make good roads available for small communities.

American Auto Coach Work. Foreign car-body builders, instead of following standard patterns, have shown a great deal of originality in the design of car bodies. This is now having its effect on our own car-body builders who are coming out this year with many artistically modeled vehicle bodies. There will be a discussion of this subject with pointed criticisms of various models both foreign and American. The article will be illustrated with a score of automobile body designs.

The Fuel Problem. The enormous demands upon our supplies of hydrocarbon fuels have made it necessary to develop new methods of obtaining fuels volatile enough to be used in the motor car. The Burton process of producing gasoline has done much to relieve the shortage. Just what this process is will be explained in full.

Purchaser's Guide. As in previous issues of the Annual Motor Number there will be a table of American made cars classified according to price, so that the prospective purchaser may know what he can buy for $500, $1,000 $1,500, etc. There will be a similar list of commercial vehicles classified according to capacity.

In addition to these and other articles there will be illustrations and brief descriptions of the latest automobile accessories. There will be an oiling chart for the automobile, explaining what parts need attention in the standard chassis and engine. A motorcycle trouble chart will explain where troubles are liable to occur and how they may be overcome or avoided.

A Colored Cover by Gerrit A. Beneker

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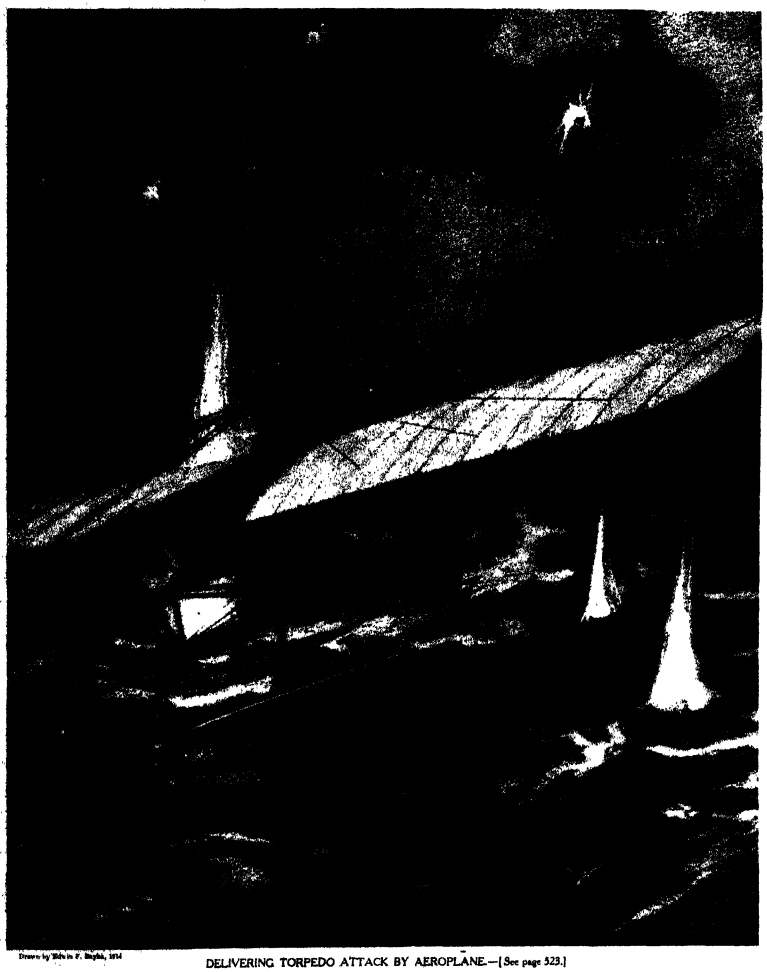
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Drawn by Edwin F. Bigelow, 1914

DELIVERING TORPEDO ATTACK BY AEROPLANE.—[See page 523.]

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Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Some Recent Naval Operations

THE past two or three weeks have been fruitful in naval operations, notably in the South Atlantic and the North Sea. In the first-named waters there was fought an engagement which must be considered as by far the most important of the present war; in the North Sea there was witnessed the first attack against the shores of England that has occurred for several centuries.

The crushing defeat and sinking of Germany's Pacific squadron by Admiral Sturdee was the natural sequel—we had almost said inevitable sequel—to the destruction of Admiral Cradock's squadron off the coast of Chile. In the last-named engagement the Germans, thanks to the admirably thought-out plans of their naval general staff and their wonderful system of naval intelligence, were able to catch a part of Cradock's squadron and attack and sink it with an overwhelming concentration of gun fire. Following upon this, it was inevitable that Great Britain should dispatch a fleet of vessels sufficiently fast and powerful to round up and sink the two armored cruisers and the few scout cruisers which made up Admiral Spee's Pacific fleet.

We know that the German fleet consisted of the armored cruisers "Scharnhorst" and "Gneisenau" and the scout cruisers "Nurnberg," "Leipzig," and "Dresden." The first four ships were sunk; the "Dresden" escaped to the Straits of Magellan and at the present writing is still being pursued by British cruisers. From the cabled dispatches, giving accounts of the action, it is evident that the British fleet greatly overpowered the German fleet; for it included an old battleship, two battle-cruisers of the "Invincible" type, 26-knot ships mounting 12-inch guns, and several fast cruisers of smaller size. That the fleet was powerful is suggested by the silence of the British government as to its composition; for if first-line ships had been detached from the Home Fleet for the purpose of finding and sinking Spee's squadron, it would be natural that the British Admiralty should not wish to make the fact of the absence of these ships from the North Sea, or from the Home Fleet, wherever it may be, known to the Germans.

It is conceivable that the weakening of the British battle-cruiser fleet may have had something to do with the recent raids by the German battle-cruisers along the British eastern coast. These cruisers are among the fastest of their class afloat, having speeds of 27 to 29 knots. Availing themselves of a dark winter's night, they passed through the line of blockading destroyers; and their presence in the North Sea was not known until, at dawn, they began a bombardment of a few seacoast towns, which appears to have lasted in no case more than half an hour. Immediately on the conclusion of the bombardment they turned and in all probability made direct for their home port. Their high speed enabled them to get back long before the fast battle-cruisers of the British, starting from their base on the British coast, or perhaps further away, could hope to intercept them. At the present writing there has been no indication that they have been intercepted or have failed to return to their home ports.

Judged from the standpoint of strategy, it is difficult to understand the object of this raid; although it has been suggested that the Germans hoped to draw the British fleet into the open or lead them into some maneuvers, say in waters that were already infested with German submarines, in which they themselves could fight at an advantage. Failing that, the only probable outcome of the attack, which, in two cases, in defiance of the usages of civilized warfare, was made upon undefended towns, one of which, Scarborough, is a popular watering place, will be to stir up the martial spirit of the English and act as a powerful incentive at the recruiting stations.

As regards the main battleship fleet of the Germans, in which is included some sixteen dreadnoughts and battle-cruisers, there seems to be a division of opinion among naval men as to its probable course of action. There are some, a small minority, who believe that, because of the overwhelming strength of the British fleet, the Germans will not risk the loss of their own fleet in an open engagement, but will endeavor to preserve it intact in the Baltic, so as to save it as an asset for the final peace negotiations. The majority, however, believe that the great fight will take place at a time and under conditions chosen by Germany, and that, although she will probably suffer a crushing defeat, it will be at an enormous sacrifice of the ships of the victors. A German naval reserve officer predicted to the writer that when the Germans were ready they would challenge the British, and that the fight would take place on the Dogger Bank. This agrees with our conviction that the Germans will endeavor so to maneuver that the engagement will occur in waters which are sufficiently shoal to be mined. It is conceivable that their plan might be to endeavor to lead the British fleet over a previously laid mine field or into waters where a fleet of submarines was asleep on the bottom and within striking distance of the British battleship line.

The War, Industrial Research, and the American Manufacturer

THOMAS A. Edison's remarkable achievement in equipping a plant which would supply him with the carbolic acid required in the making of his phonograph records, and hitherto imported from Europe, has raised in the minds of many a thinking American the very pertinent question: Why cannot other manufacturers do likewise? To be sure all manufacturers are not Edisons. On the other hand they can lay their problems before research scientists who for a comparatively small outlay devise processes which ought to render many an American absolutely independent of Europe. If the war stimulates this interest in industrial research, if it will be the indirect means of creating industries which it seemed impossible to establish in this country, the United States will profit far more than by the exportation of munitions of war and of foodstuffs.

But the problem of increasing our national wealth by industrial research involves much more than scientific investigation. The economic side must be considered as well. Our scientific experts are quite capable of solving any industrial problem that may be placed before them: but they cannot solve the problem of competing with cheap European labor. So long as there is a great disparity between wages paid in Europe and the corresponding wages paid in America, it will be hopeless in many lines of industry to achieve economic and industrial freedom.

More important still is the question of governmental co-operation. Germany's industrial greatness was established not only because her schools graduated wonderful technologists, not only because the German has a natural love for order and system, but because there stood in back of each German manufacturer an intelligent government which created the proper conditions for the growth of industry and which smoothed the path of the industrialist in foreign countries.

The relation of industrial research to the improvement of those industries which have in a large measure depended on Europe for their raw material and the attitude of our Government toward industries which might flourish if the research scientist were only given an opportunity are problems which are of such vast significance that the SCIENTIFIC AMERICAN intends to take them up in a series of articles to be published early in the year. One of our editors has made a thorough study of the effect which the war has had upon American industries; he has interviewed the foremost engineers, business men, and manufacturers in our chief industrial centers; he has questioned Government officials on their attitude toward industries which must be developed not only by the scientific man, but by sympathetic legislative co-operation; and he has spent many days in the more important laboratories of this country in which industrial research is now carried on. In our opinion the SCIENTIFIC AMERICAN will publish in this series one of the most important contributions to the literature of American industry which it has ever made.

The Political Importance of Science

IN Shaw's much-discussed article, "Common Sense About the War," reference is made to militarism. Militarism cannot be considered a science because it does not reach the objective for which it ostensibly exists. A science of agriculture must increase our knowledge of agriculture; there is no such thing as a bogus science. Because militarism is not a science, the chances of victory in war are not dependent upon certain definite principles which can be applied with a sense of fact, being almost entirely matters of consequence. Because of power and resources Germany was, as a matter of fact, being steadily overborne in the war. The political advantages gained by her were nullified. Therefore, from the science of militarism or rationale of reaching the results for which it exists, it is a pseudo science.

So far we can entirely agree with Mr. Shaw. Even although militarism is lateral and to be condemned, it remains true that some of the political advantages it was supposed to bring about are themselves desirable. We all desire permanent peace between nations, but a peace based on community of interests and common ideals rather than on equality of force. A nation has often made a bloodless and mutually advantageous conquest of another nation by purely peaceful means. Who can doubt that the friendly relations between the United States and England are due, to an enormous degree, to the fact that they have a common language, which means very largely a common culture and common ideals? As Bernhardi points out, it would not be true to say that these two great nations have common commercial and political interests; nevertheless they are at peace and likely to remain so, largely because of their common language and all that such a bond implies. The spread of a language is fraught with highly important and desirable political consequences for the nation of that language. France influences Italy more and more because all over Italy is the French novel, as H. G. Wells points out. Now what influences the spread of a language? Primarily, and most permanently, the amount of thought contained in that language. Consider the fact that we English-speaking people practically have to learn French and German in order to keep abreast of our times. We don't bother about learning Turkish because comparatively little of importance to us is expressed in Turkish. By raising the quality and quantity of valuable thought expressed through the medium of a particular language we increase the spread of that language, a spread which carries with it desirable political consequences of the greatest importance.

This causes a new point. By endowing and otherwise encouraging scientific research in a country we help to enrich the thought expressed in the language of that country; which makes for the extension of that language and never for the increased political importance of that country. We know that governments care nothing for knowledge as such, but we know they are interested in politics. Perhaps then, by insisting on the political importance of science we may get a government to consider more favorably the adequate endowment of scientific research.

Checking the Spread of Plant Diseases

THE Federal Horticultural Board, which represents the American end of a movement now becoming quite general in behalf of checking the spread of plant diseases and insect pests by means of suitable quarantine and inspection methods, has completed two years of effective work, some details of which are set forth in the second annual administrative report of the board, just at hand. In the course of the last fiscal year the board and its collaborators detected a great number of infested plants in process of shipment and proclaimed several quarantines, both domestic and foreign. In all, 191 species of noxious insects and 55 fungous diseases were reported on shipments from abroad. By preventing the entry of these pests the board has, in each case, headed off what might have proved a widespread disaster to American crops. An especially noteworthy case is that of the so-called pink boll-worm, which is now doing immense damage to cotton in Egypt, and was found on several shipments of Egyptian cotton seed offered for entry at the ports of New York and Boston. Its partly grown larvæ live in the cotton seed and is thus easily transported. The situation is made more serious by the fact that the worm may be imported not only in seed shipped as such, but also in seeds which, owing to imperfect ginning, are left in baled Egyptian cotton. A number of living worms have been found in imported cotton lint, indicating a distinct danger from the use of such cotton, especially in southern mills, which are often situated in the midst of cotton fields. The board has recently co-operated with the Bureau of Standards in experiments to determine the practicability of treating baled Egyptian cotton to destroy all contained larvæ. The test in the meantime nearly all mills using imported cotton [illegible] of picker waste and seeds from cotton-seed oil mills, also being made to prevent the dispersion of [illegible] cotton is unloaded at Federal ports. Seeds from [illegible] must be [illegible]

Science

Aerodynamics.—A new type of light-[illegible] has been successfully built abroad. [illegible] is claimed was described at a recent meeting [illegible] French Academy of Sciences. *In Dingler's Polytechnisches Journal* (Berlin), of September 20th, an abstract is given of the report thereof in the *Comptes Rendus*. According to this the new lightning rod has 2 millimeters of radium bromide inserted in its top. The result of this is said to be that the conductivity of the [illegible] of the air surrounding the top of the rod is enormously increased. It is, indeed, said to be many million times the conductivity of the air above an ordinary rod. Moreover, this increased conductivity can be detected at quite a great distance from the rod. Hence there is an unbroken interchange of electricity between this body of air and the air which generally precipitates sudden discharges by means of "strokes of lightning."

Wireless Telegraph Recorder.—Efforts of inventors are being directed toward producing a good method for taking down wireless telegraph signals by the use of the common Morse recorder, so as to have a permanent record in dot and dash upon tape in the same way as for ordinary telegraphy. A Paris inventor, A. Chaudes, claims to have solved the problem by the use of a special relay for raising local battery current on the Morse apparatus, but unlike some of the methods that have appeared for this purpose, the relay is not operated by the minute current produced by the waves themselves, for an electric relay to work on such small current must necessarily be an elaborate and a delicate one, besides being expensive. M. Chaudes makes use of the mechanical impulses which are produced by a loud-speaking telephone, so that the vibrations of the telephone serve to set in movement a suitable relay, and this latter then makes the contact for the local battery circuit. This method appears to be quite a new one and has the advantage of simplicity and low cost. By the use of the loud-speaking telephone, the message can be read at any point in a large room, and the operator no longer needs to wear the customary telephone head-piece. When it is considered desirable, the telephone can be employed without utilising the recording part of the apparatus.

The Rationale of Electroculture.—While an immense number of experiments have been carried out during the past one hundred and fifty years to ascertain the effects of electrical currents on plant growth, very little has heretofore been done toward explaining such effects as have been noted. Writing in the *Annals of Botany* (London) Messrs. R. C. Knight and J. H. Priestley refer to the experiments of Sir Oliver Lodge and others, indicating that an increased crop or an earlier ripening may be the result of electrical treatment, and describe their own experiments to determine whether these results may be due to the effect of electrical conditions upon the respiration of the plant. It was found that direct currents of a density 10^{-2} to 10^{-4} amperes have no effect upon the respiration of peas other than that due to accompanying changes of temperature, while overhead discharges producing a current density less than 8×10^{-5} amperes have no effect on respiration. Higher currents produce a definite increase in carbon dioxide, but this is attributed wholly to the rise of temperature caused by the discharge. Except by virtue of its temperature effect, an electrical current appears to have no influence upon the respiration of a plant, and in the usual field experiments the rise in temperature is negligible.

French Wireless Station in the Far East.—According to reports in the Paris journals, the new French wireless station at Shanghai will rank among the principal stations in the extreme Orient. The apparatus left France last spring, but the matter was kept secret for the time lest some other country should anticipate the movement. The station was set up in the French concession at Shanghai without its being made known to the public, and if the Chinese were surprised to see the installation, it is safe to say that the representatives of European governments, having concessions at this place, were even more so. The present station is of most modern fitting, and is the most powerful one yet to be put up in China, being designed to carry 600 miles in daytime and 1,200 miles at night. In practice these distances are much exceeded, for signals are picked up at 1,800 miles, thus reaching Saigon, in French colonial territory. Twice a day the station sends out weather indications and the local time. It gives vessels at sea all the data that may be asked for, and the post is in fact very well placed to furnish weather signals for it is connected by telephone with the meteorological Zi-Wei observatory. The station has wireless telegraphy for ships, and when needed, [illegible] connection to the French administration at Quang-[illegible] with the governments-general of Indo-China. [illegible] is to be noted that the construction of this powerful plant is due entirely to private enterprise, for it was established by a number of subscribers [illegible] among the French colony non-[illegible] at Shanghai.

Amundsen's Proposed North Polar Expedition, which, after having been twice postponed, was to have sailed next summer, has now been indefinitely postponed, on account of the European war.

"Hunting with the Camera" is permitted, under certain restrictions, on the national bird reservations, where of course a particularly happy hunting ground is offered to the photographic sportsman. Permits are granted only after eggs have hatched, and operators are allowed to work only when accompanied by a warden, so that the birds may not be unduly disturbed. Malheur Lake and Klamath Lake, Oregon, and Clear Lake, California, have been favored by the photographers.

Smithsonian Explorations.—Following its custom of recent years, the Smithsonian Institution has just issued a readable and attractively illustrated summary of the various expeditions and other forms of field-work conducted by the Institution and its several branches during the year 1913. The first section of the report, giving an account of Secretary Walcott's geological explorations in the Canadian Rockies, is illustrated with several beautiful photographs of mountain scenery, in the making of which Mr. Walcott excels. The other undertakings recorded in this report are mainly biological and anthropological, and extend over a considerable part of the world.

Philippine Asphalt.—Several recent reports from the Philippines have indicated that much importance is attached to the discovery of asphalt deposits in those islands. If the deposits should prove to be extensive, the Far East generally would benefit by the discovery, as the asphalt used there is now all imported from Europe and the United States, especially from the latter. The latest information is that the deposits consist of the variety of hard asphalt known as uintahite (from the Uinta Mountains, in Utah, where this mineral is found in abundance); also as gilsonite. They lie a few miles inland from the west coast of the island of Leyte, somewhere between the towns of Villaba and Leyte, and several mineral claims have already been located in the vicinity of the principal outcrop.

Clare Island, off the west coast of Ireland, famous in Irish history as the home and headquarters of the sixteenth century chieftainess Grace O'Malley, is the subject of a remarkable series of memoirs now in course of publication by the Royal Irish Academy, and constituting what is called the "Clare Island Survey." The investigations represented by these memoirs were carried out by over one hundred specialists in the years 1909-11, and cover the flora, fauna, geology, meteorology, etc., of the island and the adjoining mainland. This particular spot was chosen as a typical area of the west coast of Ireland, a region which provides some of the most interesting faunistic and floristic problems of Europe It is claimed that the report when finished "will provide the most complete survey of the fauna and flora of a definite area which has ever been made." Special attention has been given to questions of geographical distribution, dispersal, and ecology, and to the influence of human operations upon the flora and fauna. The report will include descriptions of some 50 species of plants and animals new to science, besides records of about 200 species new to the British Isles, and at least 1,000 new to Ireland.

A World Weather Bureau has been the cherished dream of many meteorologists, and in the current number of *Symons's Meteorological Magazine* Messrs. W. M. Hays and H. H. Clayton outline plans for such an institution, especially with a view to its use in improving crop estimates. It is pointed out that "the weather is the one great varying factor in crop production," and that by using the local records of temperature and rainfall and of destructive storms the prospects of crops can be foretold, often before the crops themselves indicate results of climatic changes. The proposed bureau would cooperate closely with the International Institute of Agriculture, in Rome, which was founded primarily for the purpose of putting the work of crop reporting throughout the world on a rational basis. We would suggest, however, that an international meteorological institute might properly undertake certain tasks not mentioned by Messrs. Hays and Clayton. One of the most urgent desiderata in meteorology is the collection, unification, and publication of climatic statistics from all parts of the world. At present such data as exist are fragmentary and heterogeneous even for the countries where climatology has been most assiduously cultivated. For example, we have hardly any statistics of the annual and monthly snowfall in most parts of Europe, where such information would be of great interest just now in connection with the war. On the other hand, there are vast regions—notably in South America—for which no climatic statistics of any kind exist. An international weather bureau, analogous to the magnetic bureau of the Carnegie Institution, would promptly enlist the services of missionaries, planters, etc., in these neglected regions in the task of filling up the gaps in the present *réseau* of meteorological stations.

Automobile

A Michigan Inventor's "Rubber Foam."—The French material, called "caoutchouc foam" which was described in a recent issue of the SCIENTIFIC AMERICAN, has an American counterpart, patented under No. 1,115,031, by a Muskegon (Mich.) inventor named Staunton Gray. According to his method, the rubber compound is mixed with a light hydrocarbon solvent, preferably benzol, benzine or xylol, and brought to a fairly stiff constituency. It is then placed in a vacuum and the vulcanizing agent is added for a sort of "cold" vulcanization.

Motor Fuel in Germany.—Late information from Germany is to the effect that alcohol and benzol are the fuels now used almost exclusively by the government cars of all descriptions, and that the only motors that absolutely require gasoline are those in the fast aeroplanes. This has released the pressure on the supply of gasoline, and the embargo placed on this fuel at the start of the war has been raised, so that private owners, at least those who have been able to retain their cars, find no difficulty in getting supplies most anywhere. Benzol and alcohol are used either separately, or mixed, and there are several carburetors in use in Germany that will handle these fuels satisfactorily.

Automobile Trade in South Africa.—A Vienna journal states that according to consular reports, automobile imports in British South Africa for the year 1913 reached $5,504,000, compared with $2,790,000 for the preceding year. Half of this great import trade enters the country by way of Port Elizabeth Out of the above total, the amount for Great Britain is $2,200,000, in round numbers, United States, $1,920,000; Canada, $800,000, Germany, $3,000,000. As regards France and Italy, who formerly dominated the South African market, they now figure for only $1,900,000 and $101,000 respectively. The tendency of the African importers is to seek a low-priced car, and this favors the extension of American, Canadian and German trade.

English Makers Abandon Annual Models.—Some English builders of pleasure cars have abandoned the old plan of bringing out a new model each year, which is adhered to during the succeeding season, and now incorporate any idea that they consider a desirable improvement in each new lot of chassis that is turned out. One influence that has tended to bring this about is the greatly decreased demand for pleasure cars at the present time in England. This weak demand for pleasure vehicles is making itself evident in another direction, for makers who have heretofore turned out four or five different powered cars are restricting their output to two or three sizes, a result that is probably desirable for many reasons.

Folding Ribs on Inner Tubes.—Preventing puncture of inner tubes of automobile tires is one of the most prolific fields for the inventor. Hundreds and even thousands of schemes have been devised, some of them working very satisfactorily One of the latest, which is as unique as it is said to be effective, is the placing of three separate and distinct ribs on the inner tube. The shape of these ribs is such as to form small airspaces when the tube is blown up, thus adding considerably to the resiliency of the tire The greater thickness of the inner tube and the difficulty which a nail or tack would have to penetrate the entire tube recommend this invention to the attention of the motorist. The few tubes made according to this design are stated to have given great satisfaction

Two Ingenious Automobile Devices.—Two new devices designed for attachment to automobiles that recently have made their appearance on the market give evidence of considerable ingenuity. The first of these is designed to show when a car is used without the authority of the owner. It consists of a small case containing clockwork which unwinds a strip of paper past a needle. The needle is fastened to a delicately balanced horizontal pendulum and perforates the paper when moved by the vibration of the car. The tape is marked off in divisions of time so that the perforations indicate not only when the car was used but also the length of time The other device would seem to have been long in demand It is a simple grease cup with a quick detachable lid so that the cup can be quickly and easily filled. The lid is held by a bayonet lock.

How Would You Disable a Steam Automobile?—The present European imbroglio which is tearing at the vitals of foreign countries has already had a number of curious results. Not the least curious is a contest which has been started by a foreign contemporary with prizes for the best answer to the question, "How would you disable a steamer?" The disablement, needless to add, is to prevent the vehicle getting into the hands of the enemy in workable condition Quite a number of contestants have suggested that the valves of the pump and injector be removed; others, have suggested hundreds of other ways in which a car might be temporarily disabled without working permanent injury. The prize winner, however, suggested that the motion blocks be removed. These are easily taken out and carried away, and cannot easily be replaced.

War Experiences of an Air Scout—I

The Diary of an American Volunteer With the Aviation Corps of the French Army

By Frederick C. Hild

The author of this article, a well-known aviator in this country, was impelled by a spirit of adventure to seek his fortune with the French army. His tedious experiences with French red tape before being admitted to service, the tests he was obliged to undergo before qualifying as an army scout, his flights over the enemy's camps, and finally a most thrilling battle in the clouds far within the German lines, together with a number of the interesting side lights on the conditions in France during the war, are described in a series of three articles, of which this is the first.—EDITOR.

ON the outbreak of the great European war I was seized with the desire to participate in the conflict, and this desire grew day by day until finally I was obliged to yield to it.

It mattered little to me which of the warring nations I would join, and finally I chose to throw in my lot with the army possessing the largest number of aeroplanes. Having been a close observer of aviation, both here and abroad, for the past four years, I came to the conclusion that France possesses the greatest number of aircraft, and so I applied to the French government, on August 31st, through its consul-general in New York city.

My application was immediately acted upon and my voluntary services accepted. It was arranged that I should leave New York Saturday, September 5th, on the French Line steamer.

Up to the week before my departure from the United States I had been giving weekly exhibitions of flying throughout New Jersey, and I immediately canceled further contracts and placed my 60 horse-power aeroplane in storage

The French consul-general presented me with two important letters of introduction, one addressed to the consul-general of France and the other a personal letter addressed to Gen. Goiran, the mayor of Nice; but should Gen. Goiran not be conveniently located, the presentation of the letter to any military official in France would accomplish for me the same purpose.

Off to the War.

When the French steamer "Espagne" left New York, on September 5th, I was on board, together with several Americans and about 700 reservists, who were going to France to fight their country's battles. There was much fun and excitement during the voyage, pleasant weather favoring us during the entire journey. The cabin passengers were shown every consideration, but the 500 reservists traveling third-class were treated no better than cattle, which was rather uncalled for, when it is taken into consideration that they were leaving their families and friends to defend their country's honor. Two days out the French fleet performed a circular called "Catechisme du Soldat à la Charge," which was circulated among the male passengers, and from then on the reservists were obliged to drill for several hours each day under the supervision of a French officer, several of whom were aboard.

Upon nearing the French coast we were stopped by two British warships, which escorted our steamer close to the port of Havre. We landed at Havre on September 14th, at 7 A. M., in a heavy rainstorm. The French officials were taking no chances of allowing an enemy to land, because we had to show our papers the day before we landed, and then to the military authorities the day we disembarked on French soil.

Red Tape at Havre.

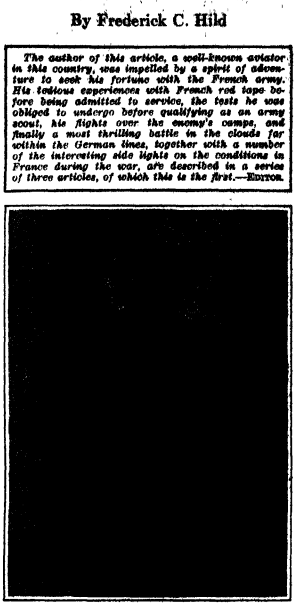
Together with a fellow aviator, a Mr. A. Flieux, a native of France, whom I had known for several years and who returned to France on the same steamer to serve his country, we went to the Bureau de Recrutement, at 55 Rue de Phalsbourg, where, upon presentation of my letters from the consul-general at New York, I was given an immediate interview with the commandant. As I could not speak any French, Mr. Flieux acted as interpreter for me and smoothed away my difficulties.

The commandant looked through my papers carefully, and after convincing himself that I was the party named therein he informed me that he must telegraph to the Minister of War at Bordeaux for instructions, and must await reply. My case was a new one to the recruiting office at Havre, as he had not dealt before with any Americans who wished to join the aviation corps. In the meantime, while waiting for the reply, I was to pass the physical test and sleep in the dormitory of the Sixty-ninth Regiment, the barracks of which were a few blocks off.

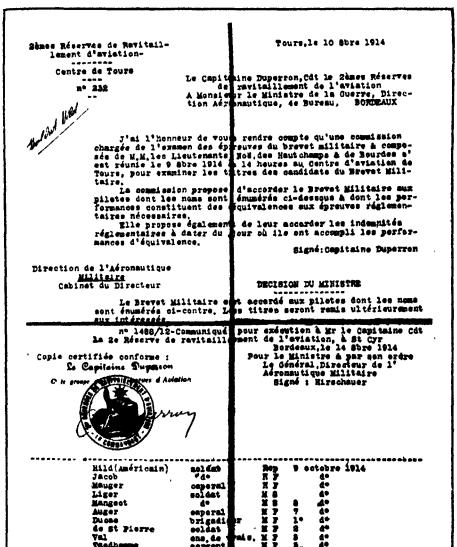
After luncheon I visited the Sixty-ninth Regiment barracks, where a great many of the soldiers there were engaged in throwing beds out of the upper story windows, which later were carted away, and I learned from the captain in charge that as there were only

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The author in his French uniform.



Mr. Hild's commission as pilot in the Aviation Corps.

Catechism of a Soldier in Time of War

To conquer in war I must have:

My courage.

My discipline,

My bayonet,

My ammunition.

My courage, to assure long suffering.

My discipline, in order to carry out blindly all the orders of my commander.

My bayonet, to drive the enemy from his position or to impale him.

My bullets, to permit me to press on up to the moment of assault.

As a sentinel I watch over the army; it is my duty to keep on my feet, in order to see, to listen, and to prevent danger.

As a scout I must protect the army on the march and be audacious in obtaining information.

On the march I must keep my place exactly.

In camp I must look after my equipment, care for my feet, my boots, rest with my rifle near me, so as to be ready at the first call to arms.

In battle, in taking the offensive my motto must be "Always forward" for the assault.

On the defensive I must hold out to the very end, even when I see the effect of fire, commencing and ceasing fire instantly at the order of my commander, supporting my rifle and, if possible, my body in order to fight the better.

When I am alone I will not fire, at more than 400 meters, on a single man, or at more than 800 meters on a group of men.

Given this day on the boat "Espagne."

Sunday, September 13th, 1914.

Translation of orders given to French soldiers.

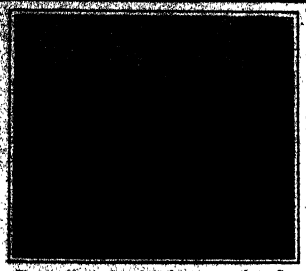


Fig. 1.—Mount San Antonio, as seen from San José, Costa Rica. Photographed in infra-red light.

Air Transparency for Infra-Red Rays*

Application of These Rays to Telephotography

By G. Michaud and J. F. Tristan,
Costa Rica State College

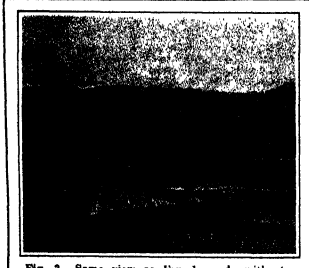


Fig. 2.—Same view as Fig. 1, made without a screen on an ordinary fast plate.

THE cause of the various and beautiful colors which the sky and clouds may assume was but little understood a few years ago, and even when Lord Rayleigh showed that the scattering of light by gaseous molecules was the greatest when the wave-length of light was the smallest, he probably did not realise at once that he had found a satisfactory explanation for all the colors, whether blue, green, yellow, or red, which can be observed in the sky, from midday till after sunset.

Ultra-violet, violet, and blue are, in the order in which they are named, the radiations which are most scattered when solar light passes through a thick layer of air. Ultra-violet is invisible and the remnant mixture of violet and blue appears to us as blue, owing to the fact that blue acts more powerfully on our retina than violet does. Such is the cause of the blue color of the sky. The atmosphere acts as a ray filter, which scatters in many directions most of the ultra-violet, violet, and blue, and allows the passing of most of the yellow, red, and infra-red. If, some time before sunset, an observer turns his back to the sun and holds vertically above his eyes a sheet of white paper, in such a way as to have the direct rays of the sun fall upon the paper, while he sees both the blue sky and the paper side by side, he has an opportunity to compare the color of the ray filter with that of the filtered rays, i. e., the color of the light scattered by the atmosphere with that of the light which has passed through it and which is reflected by the paper. Even at noon, in June, in the northern hemisphere, when the atmospheric ray filter is as thin as it may be for a given altitude, the paper is tinged with a yellowish hue. Painters are aware of that fact, and, as a rule, exaggerate the yellowish effect when they wish to brush a sunny spot.

White light which has lost some of its blue and violet components appears as yellow. If, however, it has lost not only the ultra-violet, violet and blue, but also part of the green, that is to say part of the wave-lengths which come next to the blue in the list of colors arranged by order of decreasing wave-length, red as well as yellow predominates in it and gives it an orange or even reddish hue. Such a phenomenon occurs at sunrise and sunset, when the sun is near the horison and when, owing to the great obliquity of its rays, the thicker atmospheric filter has begun to scatter a notable proportion of the green radiations. Such a thick layer of air remains fairly transparent, then, only for the less refrangible wave-lengths: orange, red, and infra-red. *High clouds*, when illuminated by rays thus filtered, take beautiful orange and red colors.

Occasionally, long after sunset, when general darkness has come, in atmospheric conditions the nature of which has not yet been made quite clear, a corner of the western sky will be seen to assume a deep ruby color which the physicist who has somewhat dabbled into spectral studies will readily recognize as the extreme spectral red. Sunlight, in such circumstances, has traveled through a maximum thickness of air. It probably illuminates tenuous dust particles which stand far above the clouds, with a light in which only the greater wave-lengths, extreme red and infra-red, have been left; a light which the eye could not perceive were it not for the fact that everything else has been submerged into darkness. It would be extremely interesting, when such phenomenon occurs, to take a photograph of the western sky with a plate sensitive to the infra-red, some time after the vanishing of the very last glow of visible light. That an impression would be made on the plate is probable, as the invisible infra-red radiations will still pass through an atmospheric layer of such a thickness as to intercept every other radiation.

This curious property of infra-red light suggests its application to telephotography. If the eye could be made, even temporarily, sensitive to the infra-red, the same property would find a ready application to television, as one of the greatest obstacles to a clear vision of far-away terrestrial objects through a powerful telescope is the blue haze which wraps and partially hides everything. Telephotography with infra red light was attempted for the first time by us in 1912, with Prof Wood's filter. The results, which have been published elsewhere, were encouraging enough, but the length of exposure (from 15 to 20 minutes for a sunny landscape, with the greatest lens aperture) forbade many applications. As the sensitiveness of ordinary plates comes to an end with any wave-length longer than that corresponding to the green, special plates, manufactured by the English firm, Wratten & Wainwright of Croydon, were used for those early attempts. These plates, expressly made for spectral studies, are somewhat sensitive to the infra-red, but only as far as wave-length 8,000 A. U. owing to the fact that the main object of their makers is sensitiveness, not so much to extremely long wave radiations as to every visible radiation

During several attempts to carry this sensitiveness farther on the infra-red side of the spectrum, the writers used most of the dyes which have been recommended as good sensitizers for the red, namely cyanin, dicyanin, chlorophyl, alizarin blue S. They found in the last named of these dyes a sensitizing agent which, when used in combination with silver nitrate, besides allowing them to reach a region of the spectrum which was probably *terra incognita* for the photographers, reduces the exposure to some two minutes, for a sunny landscape, with diaphragm one eighth. Such plates are easily sensitized and yield constant results, but must be dyed by the experimenter himself, as they begin to lose their remarkable optical properties a few hours after being sensitized.

The accompanying photographs of mountain ranges some 8 to 15 miles from the city of San José, Costa Rica, give an idea of the wonderful clearness of vision which would be bestowed upon our retina with the gift of sensitiveness to infra-red light. Fig. 4, made on an orthochromatic plate, with a weak yellow screen, shows the far-away, hazy, mountain about as it appears to the eye. In photographs (not here reproduced) made with about the shortest wave-lengths (3,160 to 3,200 A. U.) found in sunlight at sea level, the mountain range has all but vanished. If ultra-violet wave-length 2,118 A. U. were contained in sunlight in the lower regions of the atmosphere, and could

(Concluded on page 531)

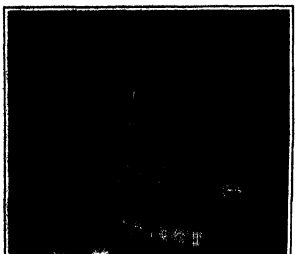


Fig. 3.—The Sierra Candelaria Mountains, as seen from San José, Costa Rica. Photographed in infra-red light.

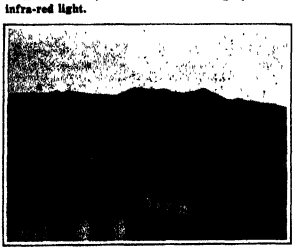


Fig. 4.—Same view as Fig. 3, made on an orthochromatic plate with a weak yellow screen. Distant objects appear about as the eye sees them.

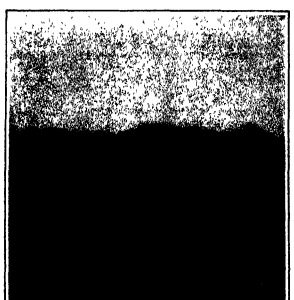
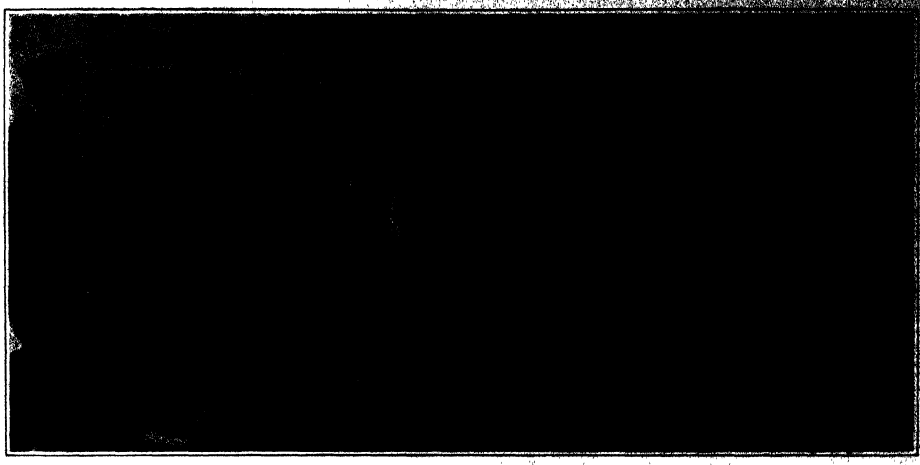


Fig. 5.—Same view as Fig. 1. Photographed without a screen on an ordinary fast plate.

* *La Nature*, September 7th, 1912.



Fig. 6.—Pelagus Mountains, as seen from San José, Costa Rica. Photographed in infra-red light.



An English officer instructing a scouting party with a model of the seat of war made in sand.

Strategic Moves of the War

Letter from the Military Correspondent of the Scientific American, December 19th, 1914

The Campaign in France and Belgium.

THE general aggressive campaign of the Allies to drive back the German line has not developed definitely yet, but many signs point to increasing activity on the part of the former The beginning of such a campaign would naturally consist of attacks all along the line from Switzerland to the North Sea coast. In this way the Allies would try out the strength of the German defense and would be able to locate the points at which a further attack in strength would have best chances of success.

Two important considerations impel the French and British to adopt a vigorous campaign at the earliest moment warranted by the state of their military preparedness. One is the decrease in power of the German armies that would result from demands for active operations on both their eastern and their western borders. The other is the impossibility of considering peace terms while Germany occupies a large part of Belgium and France.

It seems evident that all of the combatants are withholding news of their movements for several days in order to avoid giving information to the enemy. While the enemy of course know of the fact of the attack on certain positions, they necessarily have only an uncertain estimate as to the importance of this move in their opponent's plans. The dispatches of each army to its home government are valuable information to the enemy in that they betray inside history of the plans. For this reason it is out of the question for any first rate military power to permit real news of the operations of the armies to be published without restriction.

It was such a dispatch, published in the London *Times* in August, 1870, that is credited with betraying to the Germans the move of Marshal MacMahon's army to relieve Metz After a three days' march toward Paris on the mistaken estimate that the French army would be found there, the German armies received the correct information, turned north, and succeeded in surrounding MacMahon's army at Sedan and forcing its surrender

The majority of the affairs reported during the week were along the northern part of the line between Arras and the coast The most notable gain by the Allies was made at Ypres, where the British troops pushed forward a salient for five miles along the railroad toward Roulers. The German line has held firm on both sides of this point, so that the British are as yet insecure in their possession of this ground recently gained. By attack at Zillebecke, three miles southeast of Ypres, and at Langhemarck, four miles to the northeast, the Germans attempted unsuccessfully to break in the flanks of the British salient.

A new attempt of the Allies to advance along the coast during the last part of the week was less successful in spite of the assistance of the naval gunboats in bombarding the German position near Westende. The Germans repulsed these attacks with large losses. This field is the most likely line of advance for the British and Belgians when they start their much-heralded forward move. If these attacks are strongly pressed it will indicate the commencement of this aggressive move

The confidence of the French in their present position is indicated by their admission of earlier reverses that have been concealed until now. In the Chaulnes and Roye district the French have regained Rouvroy, Parvillers, and Andechy, three miles west of the line of the above cities. While the French seem to have now regained the upper hand in this district, they were evidently driven back three miles in the fighting of the preceding month.

The plateau in the angle between the Aisne and the Oise rivers has been the scene of especially vigorous fighting since the armies first confronted each other in this district in September. Tracy-le-Val has changed hands a number of times. In spite of repeated attacks and counter-attacks, the opposing lines have not changed position materially.

From this point to the Vosges Mountains the opposing lines have nowhere moved sufficiently to show on even a large scale map. At Varennes, where the battle line crosses the upper Aisne, and at Ailly and Apremont, one and five miles east of St. Mihiel, the French have made repeated but unsuccessful efforts to break through the German lines.

In Upper Alsace the Germans have not only checked the French invasion, but have recovered ground to a slight extent at both points. East of Thann they have recaptured Steinbach. By a flanking move along the Swiss border they reached Pfetterhausen on the French border and forced the French to fall back to a position west of Altkirch.

Considering the entire battle line in France and Belgium, the advantage in the fighting during the week lies with the Allies. The numerous attacks that they are now making show a marked change in their plan of operations. A significant item in the dispatches is the frequent report of heavier guns in the French artillery. If they have made good their deficiency in this type of armament, their chances will be much strengthened in case they should undertake an aggressive move.

The most noteworthy feature of the fighting in this field has, however, been the success of the Germans in holding back largely superior forces for over two months while delivering their great effort against Russia. The military resources of the nation are necessarily limited; the operations in Russia indicate a strength of probably 1,500,000 men for the eastern campaign. It seems unlikely, then, that they can have more than 2,000,000 men for the western campaign. The British, French, and Belgians must outnumber the Germans by five to four, or even more.

The Campaign in Russia.

The most important moves of the week were on the flanks of the great battle line that stretches from the Carpathian Mountains to the East Prussian border north of Warsaw. From the north the Germans rushed forward an army from Soldau in the effort to get behind the Russian right flank. At the same time the Austrians made an advance from the Carpathian Mountains in an attack on the rear of the Russian left flank.

The German expeditionary army under Gen. Francois advanced from Osterode and Soldau in East Prussia and defeated the Russians southeast of Mlawa. Their further advance carried them to Prasnysnz and Ciechanow, twenty-five miles south of the German border.

Their object in this move was not to waste time and men in an attack on the great Russian fortress at Novo Georgievsk on the Vistula northwest of Warsaw. It was to strike southeastward toward Pultusk and Rosjan in an effort to capture the main railroad running from Warsaw to Petrograd. This line of communication is so important for the Russians that they would necessarily have to rush a large number of troops for its defense. The Russian campaign west of the Vistula would be correspondingly weakened.

On December 14th the army of Gen. Francois was defeated at Ciechanow and was forced to fall back to its former position near Mlawa. This relieves the Russian right flank of danger and enables them to give greater strength to their battle line west of Warsaw.

On their left flank the campaign has been going in favor of the Austrians. The Russians had advanced to Wieliczka and Dobeyce, ten miles from Cracow. The advance of an Austro-German army along the railroad toward Novi Sandec so threatened this exposed Russian position that they were forced to fall back to Nisko-emice, fourteen miles east of Cracow.

An important flanking move was made by the Austrians through the passes of the Carpathians farther to the east. They moved northward in large force and captured Dukla. By a further advance to Jasio they cut off the Russian army at Novi Sandec and forced it either to retreat northward toward Tarnow or to fight under disadvantageous circumstances. If the Austrians are able to press this flanking move through Jasio they will to a large extent relieve the pressure on Cracow.

In the center of this battle line from Czenstochowa to the Vistula River the Germans succeeded in pressing back the Russian line to a position running through Radomsko and Lodz to Lowicz and then along the Bzura River to the Vistula. The Germans have continued their efforts to press forward [illegible] and the Russian defense seems to have [illegible] has checked the German invasion [illegible]

By making this advance [illegible] Poland, the Germans have [illegible] line in readiness [illegible] of communication [illegible]

(Continued on page 641.)

Torpedo Attack from the Air

IF the modern automobile torpedo can only thrust its nose against the side of a warship, that ship ceases to exist as a fighting unit of the fleet; instantly it is put out of action, and probably it will go to the bottom. The blow of a single modern torpedo, carrying from 200 to 300 pounds of explosive in its warhead, can send any one of the older warships to the bottom in quick time, as witness the loss of the "Aboukir," "Cressy," and "Hogue"; and it is pretty well certain that the blow of two torpedoes would do the *same* for the most modern dreadnought.

That the torpedo will cripple or sink the enemy, if it once gets home, is an absolute certainty; but the great problem is to bring the gun-platform from which the torpedo is fired sufficiently close to the target to make sure of this overwhelmingly destructive weapon hitting the mark.

As matters now stand, there are three methods of bringing the torpedo within hitting range—the hitting range in the most powerful modern torpedoes being 10,000 yards. First, they may be fired from battleship-cruisers and other large surface vessels through under-water tubes; second, they may be fired from tubes carried upon the decks of torpedo-boat destroyers, and third, they may be fired from submarines. Aimed attack from under-water tubes on large warships is not likely to be very effective, for the reason that such ships will fight at long ranges, which, in the case of armored vessels, will probably be from 8,000 to 10,000 yards. Torpedo attack from destroyers must also, usually, be carried out at considerable ranges—this for the reason that the anti-torpedo, rapid-fire battery can concentrate such an overwhelming fire that the chances of the destroyers getting within point-blank range, at least in the daytime, are very remote. Torpedo attack from submarines is not limited to distant ranges, since it is possible for a submarine to approach, undetected, within a few hundred yards of its prey. The limitations of *submarine attacks* are due to the slow speed, both on the surface and submerged, of the submarine as compared with the ship attacked. At the surface the submarine must keep outside of the range of torpedo-defense guns, and, if it submerges, it at once becomes blind and its slow speed renders it very improbable that it can get within striking distance of an enemy that is moving rapidly.

To render torpedo attack absolutely effective, the torpedoes should be launched at a distance of between 1,500 and 2,000 yards, at which ranges the torpedo officer can estimate the speed of the ship aimed at so closely that the torpedo with its high speed of 35 to 40 knots is certain of finding its quarry.

The problem of delivering torpedo attack at this close range has been worked out along novel and promising lines by Admiral Bradley A. Fiske of our Navy, who has conceived the bold idea of using a swift and powerful aeroplane for bringing the torpedo within the point-blank zone of fire and delivering the attack at distances which will make a hit inevitable. Fiske's method, as illustrated on the colored cover of this issue, is to attach the torpedo below the body of the aeroplane in such a way that its axis will coincide with the longitudinal axis of the machine. The attachment is such that the airman, by pulling a lever, can release the torpedo at the moment when it is aligned on the proper course to make a hit. Once it has dropped into the water, its automatic mechanism will submerge it to the required depth of about fifteen feet and steer it unerringly to the target.

In making the attack, the aeroplane would rise to an altitude of from 2,000 to 2,500 feet, and approach until it was within striking distance, when it would descend in a sharp spiral within a short distance of the water. The airman would now steady his machine for an instant, until it and its torpedo were pointing on the true line of fire, when the attack would be delivered by the simple pulling of the lever above mentioned.

The preferred time of attack would be on a clear night on which the dark mass of the ship to be attacked would be plainly discernible from above. The chances of discovery by the searchlights of an enemy before the aeroplane was within firing distance would be remote; and even in case of discovery, it would be difficult for the ship's guns to hit a fast-flying machine that was descending in rapid spirals of small diameter.

Shackleton's Plans Upset.—When Sir Ernest Shackleton left Buenos Aires last October on his Antarctic expedition it was arranged that he would proceed in the "Endurance" and that another section of the expedition on the "Aurora" would go to the Ross Sea, on the New Zealand side of the Antarctic, where the two divisions would meet in April, 1915, or at latest in March, 1916. It appears now from reports from Sydney, N. S. W., that a strike in the dockyards has delayed the departure of the "Aurora," thus entirely upsetting all plans, and that it will not be possible for Sir Ernest to start on his transantarctic journey until next year.

forts. If the guns of the forts had had an equal or greater range, there the would have made the setting of the German guns absolutely impossible.

As to which one ultimately use the largest gun, I say that it is the forts, or any other kind of permanent fortification, because it is possible to secure foundations of any desired strength. With movable guns, it is not possible to establish a concrete foundation beyond a certain size, even if it could be done without being subject to the fortress' fire. Then the difficulty of transportation will limit the size of a movable gun to a point far below that of a permanent arrangement. The walls and vaults of the forts were not calculated to resist projectiles of the size used, but their strength might be considerably increased. ADRIAN GETAZ.

Knoxville, Tenn.

The Optophone and Musical Pitch

To the Editor of the SCIENTIFIC AMERICAN:

Some time ago I wrote you about the optophone in reference to the height of the letters used. Since then I have seen a better description in which they claim the optophone will read any size of type. They do not require raised or embossed letters. There is one thing about the apparatus I do not understand, viz., why do they use a right-angle prism? Why not place the Nernst lamp and the siren disk in a vertical line with the portrait lens and save the waste of light caused by the prism?

As you will see in the article, he perforates the siren disk with many holes arranged in eight concentric circles. The holes in the inner circle break the light to correspond to the note *g* of the musical scale. I have arranged the tuning he uses in the following table, placing *g* the lowest in pitch below:

e''	651.762	*c'*	325.881
c''	517.305	*d'*	290.827
b'	488.270	*c'*	258.652
g'	387.540	*g*	193.77

The figures and decimal fraction represent the double vibrations per second, according to the Standard International pitch in which *a'* has 435 double vibrations per second and *c''*, the octave above middle *c'*, has 517.3.

The article about the optophone is in the *Proceedings* of the Royal Society, Vol. 90, No. A 619, p 373.

Do *you* not think that an expert in reading from the optophone in a short time would stop spelling the words letter by letter and read the characteristic sound of each word? E. H. HAWLEY,

Custodian, Section of Musical Instruments, Smithsonian Institution.

P.S.—I append a table of the vibrations of each letter of the musical scale from below middle *C* to *C* the octave above computed with the geometrical ratio 1.05946309435. The only whole number in the scale is *a'* 435. I give *a* the octave below to show how small the error is in the computation. I have not seen similar totals carried out much farther than three decimals. I use the above ratio to determine the positions of frets the length of horn and organ pipe the positions of lateral openings in wind instruments.—E. H. H.

The International Standard Pitch.

COMPUTED TO THE ELEVENTH DECIMAL FROM *A'*, HAVING 435 DOUBLE VIBRATIONS PER SECOND

The international standard pitch has an equal tempered scale composed of 12 semitones, the number of vibrations of any letter, and the same letter an octave above the letter is double that of the first, and the geometrical ratio from any semitone of the scale to the next is that number which multiplied by itself and its product by the same multiplier twelve times the result should be two, in other words the 12th root of two, which I have worked out to the 11th decimal, getting 1.05946309435. The ratio

c''	517.80509506892	*e'*	325.88178923494
b'	488.27097109730	*d#'*	307.59144963380
a#'	460.86044809026	*d'*	290.82766829977
a'	435.00000000000	*c#'*	274.68282837132
g#'	410.38832262013	*c'*	258.65254753346
g'	387.54096239783	*b*	244.13548552865
f#'	365.78906064497	*a#*	230.43222304533
f'	345.25972381517	*a*	217.50000002288

c', the fourth letter from the bottom, is middle *c*, the beginning of the once marked octave which extends to *b* above. The letters below *c'* are of the unmarked octave; *c''* upper letter in the first of the twice marked octave. *a'* is the beginning of the computation of its number of double vibrations, 435 multiplied by the ratio above gives the semitone of above with 460.868 vibrations. This product again multiplied by the same ratio gives the vibrations for the next semitone *b'*, and so on. The semitones below *a'* are obtained by dividing 435 by the ratio, its quotient being used as a dividend for the second semitone below, and so on. E. H. HAWLEY.

Some Suggestions About the War

To the Editor of the SCIENTIFIC AMERICAN:

No doubt a great number of SCIENTIFIC AMERICAN readers must have been puzzled by the statement made in the European news that the Germans at the head of the river Sellie caused an inundation below. Also a similar statement concerning the Yser, made recently.

While several of the French rivers are of a fair size, quite a number are nothing but mere creeks. Nevertheless, they are navigable, having been "canalised." That is, dams provided with locks have been built across them, close enough together to form ponds of slack water of sufficient depth. The river thus becomes a succession of ponds, or small lakes, separated by the dams. It is easy to see that by opening both gates of a lock the water impounded behind will rush through with tremendous force. To force it is well started, the next one below is opened, then a little later a third, and so on. Of course, an enormous quantity of water will be wasted this way, and flood the country below.

[illegible] these dams, [illegible] the German guns demolished [illegible] the Belgian and French forts, every military [illegible] expected, declared that the time of [illegible] had passed. I hope it is, but I do [illegible] the German guns were much [illegible] than those of the

Garage Fire Due to Static Electricity

To the Editor of the SCIENTIFIC AMERICAN:

The results of some experiments made in an attempt to explain the cause of a recent fire in a garage, appear to be worth calling to the attention of automobile owners in general.

The fire in question seemed to come from no apparent cause while the tank of the car was being filled with gasoline. The gasoline was being run into the tank through a funnel with a strainer of chamois skin, and the gasoline in the funnel was suddenly noticed to be on fire.

If the bottom of a metal funnel is covered with chamois skin, cotton cloth, or other material through which the gasoline develops considerable friction in passing, the funnel, if not connected with the receptacle which receives the gasoline or with the ground, becomes electrically charged. If the gasoline is caught in a tin can which stands on a sheet of glass, and wires connected to the funnel and receiver, a spark can be obtained when the wires are brought together. The length of the spark depends upon the conductivity of the air, which is least on dry, cold days.

In running gasoline into the tank of a car through a strainer of chamois or other similar material, care should be taken that the funnel is not insulated from the tank by a surface coated with varnish or other non-conductor. If metallic connection between funnel and tank cannot be made directly, both should be grounded.

Brunswick, Me. MARSHALL P. CRAM.

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The foundations of this 1,000,000 bushel grain elevator failed on one side, allowing it to lean over to an angle of 30 degrees.

Righting a Twenty-thousand-ton Grain Elevator

A Novel Engineering Feat Performed on a Big Concrete Building

A REMARKABLE piece of engineering work has recently been successfully accomplished near Winnipeg, Manitoba, in straightening up and replacing in position an immense grain elevator which had settled on one side to so great an extent that it was in serious danger of overturning altogether.

This elevator, which consisted of sixty-five great circular bins, each 80 feet high, constructed of reinforced concrete, belongs to the Canadian Pacific Railway and is located at North Transcona, eight miles from Winnipeg, which is an important shipping point where great quantities of grain from the vast wheat fields of the region are handled.

The bins have a combined capacity of 1,000,000 bushels and are estimated to weigh about 20,000 tons. Owing to unforeseen conditions that developed in the subsoil beneath the structure the great block of tanks, which were tied together by the reinforced construction into a single unit, began to settle on one side, and before any adequate preventive work could be applied it had settled so far as to bury the low side of the structure to a depth of about forty feet in the ground, leaning over at an angle of about thirty degrees from the perpendicular.

There was a considerable quantity of grain stored in the bins at the time and this was removed as quickly as possible by cutting the openings in the sides of the bins, which can be seen in one of the accompanying illustrations. This was done both to save the grain and to remove as much weight from the structure as possible. At the same time heavy shoring was put in place to prevent further settling.

The next question was what could be done to save the structure, which was a new and expensive outfit that was badly needed in the business of the railway. The loose nature of the soil, however, added to the difficulties, and after considering a variety of plans a contract was given to a Montreal firm that has successfully accomplished its undertaking.

On account of the great weight of the structure and the surrounding conditions it was not considered feasible to jack it up into its original position, and another and simpler plan, which was also considered to be much safer, was adopted. But before any replacement could be undertaken it was necessary to prepare an entirely new and secure foundation, for the old foundations had proved to be entirely inadequate.

After shoring up the structure as securely as possible the contractors began work on the high side of the building by driving a series of tunnels under it at intervals of fifteen feet. As these progressed additional shoring was put in, as it would be unsafe to reduce the supporting area to any extent.

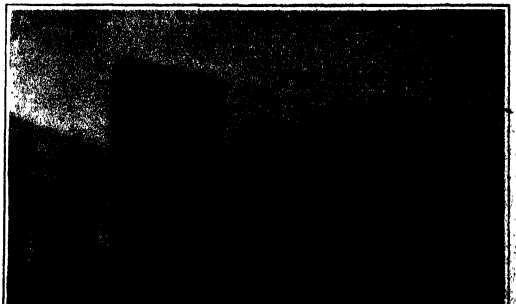
From these tunnels pier excavations were sunk to bed rock at frequent intervals, a distance varying from forty to fifty feet, and, in addition, a number of shoring piers were also constructed. Most of these foundation piers were about six feet in diameter and were of heavy reinforced concrete. Altogether seventy piers will be required for the new foundations. The material removed in driving the tunnels and sinking the foundation piers was carried out by belt conveyers, as the available working space was greatly restricted by the necessity for elaborate shoring and many heavy steel supporting girders upon which the weight of the structure was carried during the underpinning operations, and which were subsequently utilized in the operation of straightening up the building.

The operation of returning the structure to a perpendicular position is not the ordinary one of simply jacking up the low side, but is rather what may be termed a process of rolling. That is, what may be termed a longitudinal axis is established somewhat to the low side of the center longitudinal line of the building, and while the low side is jacked up the high side is correspondingly lowered. The result of this process will be to right the structure, but on the completion of the operation it will rest at a lower level than that on which it originally stood. This result appeared unavoidable, as it was considered neither safe nor possible, considering the size and weight of the structure and the character of the soil beneath and surrounding it, to attempt to both right and replace it in its original location. However, this new location will not seriously interfere with its future use, as it only necessitates some modifications of the grades of the subway tracks and the connections with the adjoining machinery building.

Rolling a large and heavy mass like this nest of bins is a most delicate operation, for its movement must be under perfect control at all times. So, besides the powerful screw lifting jacks under the lower side, it was necessary to arrange another series of jacks and shoring under the high side, so arranged that the supports on this side could be gradually relaxed as pressure was applied on the other side of the building. Arrangements also had to be made for the gradual and systematic withdrawal of the earth that was left between the tunnels that were driven under the building from the high side for the construction of the new foundations.

Fortunately the failure of the foundation did not extend to the large building adjoining the grain storage bins, which contains the power plant together with the elevating, handling, weighing and grain-cleaning machinery, and this was fortunate, as a similar settlement would undoubtedly have wrecked the mechanical outfit. Still, the foundations of this building were considerably weakened and could not be relied upon permanently.

In order to make good these defects extensive new foundation work was placed under the machinery building, which is about 180 feet high, and this included the construction of four huge concrete piers extending down to bed rock and the strengthening of the basement walls of this building to make sure



The great reinforced concrete elevator near Winnipeg as it now appears after having been rolled back into an upright position.

tractor. Before attempting it has been a most delicate and perplexing problem, and which has cried for its solution in economic and successful ways.

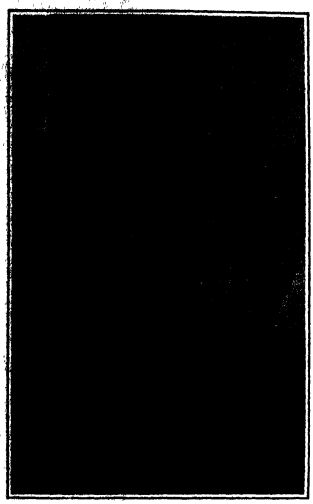
Powerful Motor Tractors

One of the most important branches of the motor vehicle field, and the one that is rapidly becoming prominent in the industry, is the commercial vehicle. Of this class an important subdivision is the tractor for heavy hauling, and these are not only most valuable for many kinds of work on the farm—indeed large modern farms could not be operated without them—but just at present the reports from abroad of the feats performed in hauling heavy guns emphasize their importance. Steam-powered tractors have been extensively employed for years, but the improvement in internal combustion engines has greatly stimulated the industry and tended to the development of many details, so that the gasoline or oil tractor of to-day is a remarkably efficient production. One of the most important parts of farm work is plowing, and for this great tractive power is required, and it is of advantage if this can be secured without letting the machine sink deeply into the earth on the one hand, or compact the earth too much on the other; and this result could be secured when ordinary wheels are used only by making them excessively large and wide, which is frequently not permissible. With a view to overcoming the difficulties inherent in the ordinary wheel various devices have been produced, but one of the most successful has proved to be the "caterpillar" system which appears to give unlimited traction, and will work over very soft ground without sinking in, and when plowing it does not seriously compact the soil. In this arrangement there are two driving wheels on either side of the machine about five feet apart, and running on them as pulleys is a wide belt of steel plate links, with a projecting gripping arrangement on the face of each link to give a hold on the ground.

In a demonstration this fall a tractor of this description, having a six-cylinder internal combustion motor with 7¾ by 8-inch cylinders, and having a tractor belt 2 feet wide, pulled twenty-four plows, turning furrows 14 inches wide and 7 to 8 deep in hard, dry soil. This outfit turned over a strip 28 feet wide at a speed of 2½ miles an hour, or at the rate of 7¼ acres; and it is estimated that the draw-bar pull equaled 80 per cent of the weight of the tractor, which is far in excess of what can be obtained by any other haulage system.

Oven Temperatures

IN a bulletin of the New York Teachers' College, Miss M. B. van Arsdale urges the more general use of oven-thermometers in the kitchen and the introduction of definite specifications of temperature in place of the vague descriptions that now generally accompany recipes. She also gives the results of a number of experiments on the relation of time and oven temperatures to the cooking of various kinds of foods. The following classification of oven temperatures is suggested: Low temperature (250-350 degrees), custards, meringues; low to moderate, sponge cake, angel food; moderate (350-400 degrees), bread, gingerbread, plain cake, cookies; hot or "quick" (400-450 degrees), Parker House rolls; hot to very hot, baking powder biscuit. Pastry (pies) begins at 500 degrees, finishes at 450 degrees.



The elaborate shoring at the high side of the Canadian Pacific grain elevator for supporting and controlling its weight while new foundations were being placed underneath.

$500 Prize for "Made in the U. S. A." Trade-mark

THE idea is springing up in various localities to adopt a "Made in the U. S. A." trade-mark, not only to meet the requirements of some foreign countries in regard to the marking of imported goods, but for the further purpose of impressing upon our own people, some of whom buy foreign products simply because they are "imported," that American-made goods are fully the equal of any we have been getting abroad. In adopting this idea the Detroit Board of Commerce hopes to inaugurate something of a national movement, and for this purpose it is offering a prize of $500 for the best design for such a mark. This design, which must conform to the regulations contained in the U. S. Trade-mark laws, is to include the words "Made in Detroit, U. S. A.," but must be national in its character and such that it can be appropriately adopted by any other city, and the space occupied by the name of the city must be so arranged that any other city may be easily substituted.

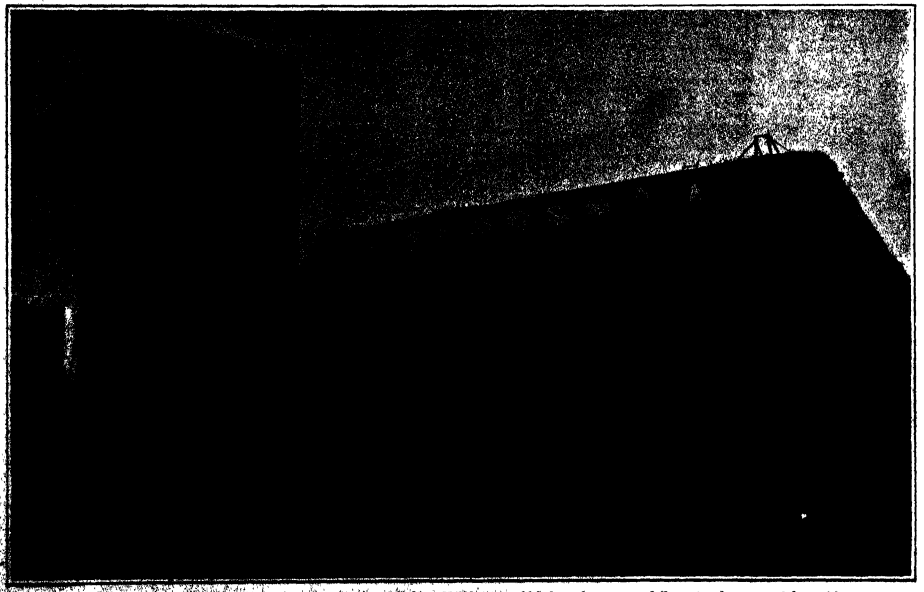
After the selection of the design it is the intention of the Detroit Board of Commerce to offer it to other boards, National Association of Manufacturers and other similar associations, with a view to making the movement national in its scope and to induce manufacturers to adopt a uniform design that shall represent the entire country.

This prize competition will close on February 25th and all artists desiring to enter can obtain copies of the rules of the contest by addressing the Chairman of the Made in America Committee, Detroit Board of Commerce, Detroit, Mich.

To Our Subscribers

WE are at the close of another year—the seventieth of the SCIENTIFIC AMERICAN'S life. Since the subscription of many a subscriber expires, it will not be amiss to call attention to the fact that the sending of the paper will be discontinued if the subscription be not renewed. In order to avoid any interruption in the receipt of the paper, subscriptions should be renewed before the publication of the first issue of the new year.

To those who are not familiar with the SCIENTIFIC AMERICAN SUPPLEMENT a word may not be out of place. The SCIENTIFIC AMERICAN SUPPLEMENT contains articles too long for insertion in the SCIENTIFIC AMERICAN, as well as translations from foreign periodicals, the information contained in which would otherwise be inaccessible. By taking the SCIENTIFIC AMERICAN and SUPPLEMENT the subscriber receives the benefit of a reduction in the subscription price.



View of the great reinforced concrete grain bins, weighing 30,000 tons, which have been successfully restored to an upright position.

The Methods of Hindu Jugglery and Magic

The Indian Basket Trick

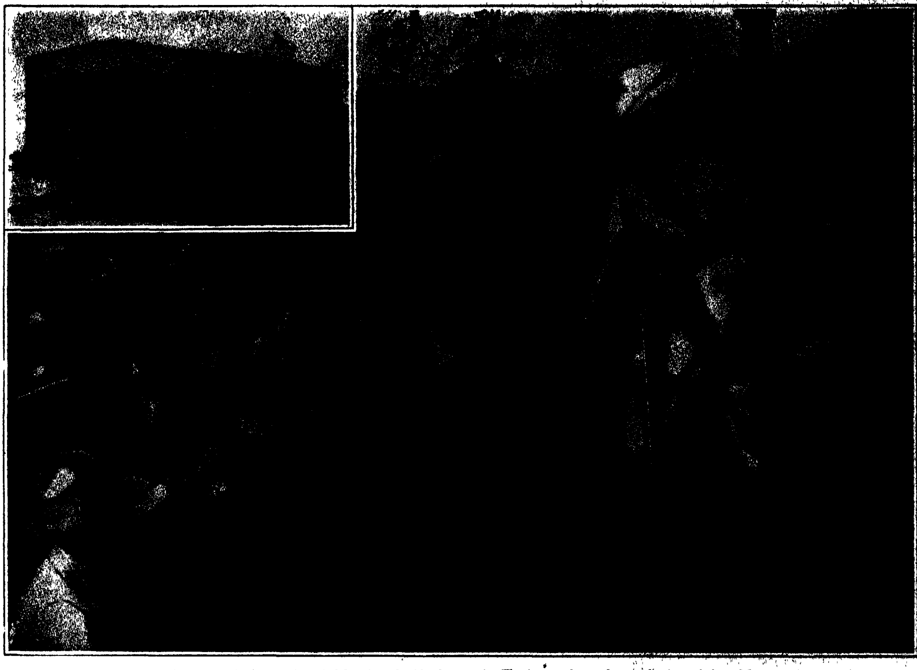
By Prince Sarath Ghosh, F.R.A.S.

THERE has been greater misunderstanding about Hindu jugglery than about any other Oriental institution, practice, or body of knowledge. The scores of writers, European or American, who have essayed to elucidate the subject have only succeeded in casting a veil of obscurity around it, by each contradicting the others or themselves unwittingly. Each started with a preconceived notion, a pet hypothesis, and tried to fit the facts to it. Some sought for mysticism in it, and found it. Some sought for pure trickery, and found it; some, finding all other methods futile, denied everything, even the facts; some others, more daring, invented the facts. In reality the truth about Hindu jugglery or magic, or call it what we will, is very simple; it is the explanation that is supremely difficult.

flat of his sword. Leaving the basket there, he goes to the child, who is still talking to the spectators. But with a sudden shriek of terror she runs round and round the arena—of course in full view of the spectators. The juggler chases her and nearly catches her. With redoubled effort she dives hither and thither to dodge him. At last exhausted, she suddenly dives behind the musicians, but the next instant the juggler swoops down on her, stands over her a moment, shaking her and upbraiding her. Then he snatches her up and carries her struggling in his arms to the basket. Kicking up the basket with his foot to its normal side, he pushes her in. Banging down the lid, he thrusts down the sword through the middle of the basket as far as it will go. There is a shriek from the inside. The

public. It is the missing girl. "Go and show thyself to that nice gentleman and receive thy present," the juggler says to her from a distance without going near her, till the spectators have satisfied themselves she is the same girl. Meanwhile the basket and the cloak have been removed by the assistants.

Here is the explanation. The removal of the basket and the cloak by the assistants implies that there is something to hide. But the juggler himself might do that while the spectators are examining the girl. Hence, the assistants are not really needed to remove the basket and the cloak; and "making music" is also superfluous for the trick. Thus the assistants are there for another purpose! That supplies the secret! There is another *girl!* She need not be like the first girl,



The Indian basket trick. Withdrawing the bloody sword. The insert shows the mechanism of the trick.

The once famous basket trick of India is also now copied on the European stage with a cartload of paraphernalia and hidden appliances. The Hindu juggler brought for this trick only a basket, necessarily a large one, a sword, and a little girl. The two or three assistants who also came had no obvious purpose; they merely sang and "made music." The juggler calls the girl, who is very prettily dressed in distinctive colors, and starts to quizzing her.

"Arré, thou incarnation of mischief, be still—do not fidget! What an upturned nose thou hast, and large mouth, and receding chin," thus pointing out all her characteristic features. "Go to that nice gentleman and talk to him a moment, he will give thee a present if thou dost this trick without a fault." All that is meant to enable the spectators to scrutinize her and identify her afterwards.

Then the juggler brings out the basket; it is about three feet long, two wide, and two deep; its lid opens along its length. He raises the lid and turns the basket on its front edge to show the spectators that it is empty, to make quite sure he turns down the face of the basket to the ground and beats the bottom with the

juggler withdraws the sword, covered with blood, and thrusts it again and again along the longitudinal line of the middle of the basket; the child shrieks at each thrust, but fainter and fainter. At last the shrieks die away. The juggler stands a moment amid the oppressive stillness. Then suddenly he opens the lid, turns up the basket to the spectators along its front edge, shows it blood-smeared but empty; and to make quite sure, he turns down the face of the basket to the ground quickly and beats the bottom with the flat of the sword, as before. Then a sudden remorse seizes him.

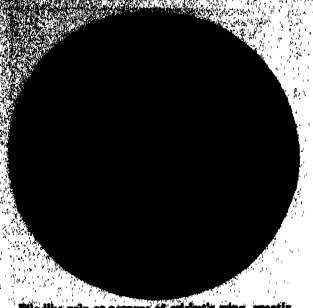
"Oh, what have I done, what have I done! I have killed my child! I have sent her soul wandering through space, awaiting nirvana." He looks hither and thither in despair.

Suddenly a small treble voice from a distance answers him: "I am here!" The spectators look around, but see nothing. "Where, my child?" the juggler cries. The voice comes again, near and nearer. At last a small figure, draped in a cloak from head to feet, emerges from the back of the spectators—where least expected—and comes to the center of the arena. The figure drops the cloak and stands in full view of the

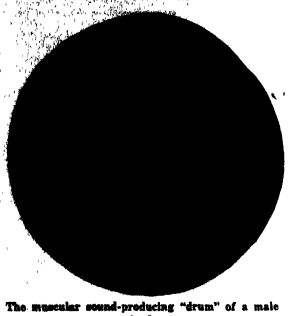
except only in size and in details of dress. While the first girl is being shown round before the trick and the spectators are all intent on scrutinizing her, the second girl—who is dressed exactly like the first, but is covered with a cloak—comes quietly from the back and huddles down behind the musicians. If by any chance anyone has noticed her while coming, it is immaterial; her face being different and her dress unseen beneath the cloak, nobody would anticipate her possible connection with the trick or even with the party of jugglers.

Then when the first girl is chased by the juggler round the arena and she dives at last behind the musicians, and the juggler seemingly stands over her, shaking her and upbraiding her, in reality he flings the cloak from the adjacent second girl onto the first and snatches up the second girl and thrusts her into the basket; and as she struggles in his arms the spectators [illegible] that she is a different girl. [illegible] while, as the attention of the audience is [illegible] the [illegible] girl, [illegible] in the cloak, [illegible] a detour, and waits at the back of the spectators till the

(Concluded on page [illegible].)



File-like vein or nervure of cricket's wing, greatly magnified.



The muscular sound-producing "drum" of a male cicada.



Stridulating ridge on hind leg of a male grasshopper.

The "Ears" and Sound-Producing Mechanisms of Insects

Curious Substitutes for Vocal Organs

By Harold Bastin

WHILE it is a fact that insects have no vocal organs, in the strict sense of the term, many species are nevertheless capable of producing loud sounds. Probably the most noisy of all insects are the cicadas, commonly called "locusts." Their resounding hum may be heard each year during the height of summer; but to appreciate fully the sound-producing mechanisms of cicadas one must needs visit the tropics. In Brazil, for example, a very large species gives a sort of scream that is astonishingly loud.

If we examine the under surface of a male cicada we shall find two plates which spring from the metathorax (i. e. the hindmost of the three thoracic segments) and overlap the abdomen to a greater or less extent. Beneath each plate, or operculum, there is a cavity which contains the sound-producing mechanism. The most noticeable organ is a membrane, or drum, to which a muscle is attached. It is to the rapid vibration of this drum that the so-called "song" of the cicada is primarily due, although other membranes within the cavity are probably also agitated, while the whole skeleton of the insect, including the opercula, presumably helps to increase or modify the sound.

Apart from the cicadas most other insects that produce sounds do so by virtue of a "stridulating apparatus." In other words, one part of the body is rubbed against another part, much as the bow is rubbed across the strings of a violin. For example, the chirping of short-horned grasshoppers, or *Locustidæ* (the *Acrididæ* of many authors) is produced by rubbing the thigh or femur of the hind leg against the fore wing, or tegmen. On the inner side of each hind femur there is a ridge surmounted by a row of minute tubercles—really modified hairs. These are rubbed against a prominent vein on the tegmen, and a shrill sound is produced. So far as is known, only the smaller kinds of grasshoppers possess this musical apparatus; the larger species of the family are apparently quite silent.

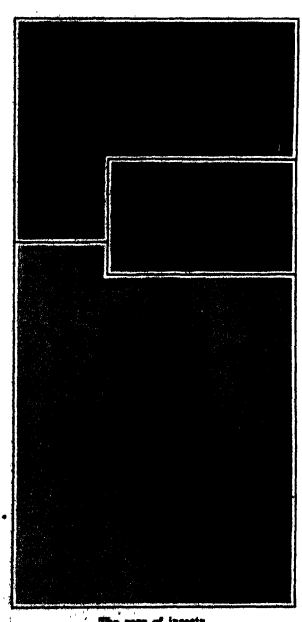
It is scarcely necessary to remind the reader that the crickets and long-horned grasshoppers (including the well-known "katydids") are extremely tuneful insects. In both these families the sound is due to the structure and movement of the tegmina, unassisted by the legs. There is, however, a difference in detail. In crickets (*Gryllidæ*) the tegmina of the males are nearly alike, the right one being commonly, though not invariably, uppermost. Each tegmen has a file-like vein, or nervure, on its lower aspect. With the file, the insect rasps a prominent ridge on the upper aspect of the tegmen which lies below. In long-horned grasshoppers (*Phasgonuridæ*), however, only the left tegmen (which is invariably uppermost when the insect is at rest) is furnished with a file-like vein. It should be added that in both these families the tegmina are often remarkably modified, doubtless with the object of increasing the sound volume.

With respect to the origin of sound-producing mechanisms among insects most naturalists agree that they are the outcome of long-continued natural selection. It [illegible] energetically shuffling together its wings, raised almost vertically, the female may be seen standing just behind him, and with her head applied to the base of the wings, and getting the benefit of every note produced."

The fact that many insects are able to produce sounds leads us, not unnaturally, to conclude that they are able also to hear. But in general it has proved very difficult to demonstrate in these creatures any structures that can, with certainty, be regarded as "ears"—that is to say, as specialised auditory organs. For example, among cicadas—a family which admittedly includes the most noisy of all insects—science has completely failed in her efforts to discover any organ of the kind. This has given rise to no little speculation, and more than one ambiguous theory has been advanced. Certain naturalists, among them Girard, are of opinion that cicadas do not hear in our sense of the word, but "feel rhythmical vibrations." One is inclined to regard this as a distinction without a difference! Again, Swinton claims that one of the membranes connected with the sound-producing mechanism is auditory in function; but if this is so, as Dr. David Sharp remarks, "the male would be deafened by his own noise, while the females, not possessing the organ, should not hear the song."

It is a fact that the sense mechanism of an insect includes vast numbers of minute "nerve endings" which, through microscopic pores in the chitinous exoskeleton, communicate with the centers of perception. The precise functions of these nerve endings, even when their character has received careful investigation, is usually difficult to determine. But we are not without evidence to justify the assumption that while it is often tactile or olfactory it is sometimes auditory. We are free to believe, in fine, that cicadas and possibly insects of many other kinds—are gifted with a generalized faculty for receiving sound vibrations; and that in this sense they may be said to "hear," notwithstanding the fact that specialized auditory organs are absent.

With certain insects—notably the grasshoppers, crickets, and their allies—the case is quite different. Here we find definite ear-like organs, admirably adapted for the reception and transmission of sound waves. Briefly, there is a tympanum, or "drum," with a complex arrangement of nerve, muscles, and tracheal tubes. These organs are paired, but their external openings are not in the head—as is the case with those of the ears of vertebrate animals. The "ears" of a meadow grasshopper, for example, are to be found in the first abdominal segment, the openings being immediately above the articulations of the hind legs. Similar auditory organs have their place in the fore shins, or tibiæ, of crickets, as well as of long-horned or tree-frequenting grasshoppers, while Folsom states that structures, presumably analogous in function, are found on the tibiæ of ants, termites, and stone-flies (*Perlidæ*); on the femora (*thighs*) of lice (*Pediculidæ*); and on the tarsi (feet) of some beetles (*Coleoptera*).



The ears of insects.

1. Young grasshopper with wing rudiments pulled back to show the "ear." 2. In the long-horned grasshoppers the external opening of the ear is in the shin. 3. Male cicada at rest. The plate-like cover, or operculum, of its right sound-producing organ is plainly visible. Swinton claims that one of the membranes beneath the operculum is auditory in function.

Many species of flies (*Diptera*) possess organs whose general structure resembles that which has been described above. In the blow-fly, for example, Lowne describes a circular "drum" in connection with air-spaces and nerve-endings—the whole being situated in a cavity beneath the base of the wing; while above this drum, under the scutellum, is a supra-tympanal organ, like that of a long-horned grasshopper.

According to Child, a very beautiful "ear" is found in the second antennal joint of many insects—the organ being most perfectly developed in the males of certain mosquitoes and midges. The joint in question is greatly swollen and cup-shaped; and although in the females of these insects a similar structure is present, it is far less perfectly developed. From this it is natural to assume that the male mosquito relies chiefly upon his sense of hearing when seeking a mate; and, indeed, it has been shown that the minute lateral hairs on the shafts of the insect's antennæ vibrate to the note produced by the female's humming flight, and that they do so most strongly when the sound waves strike them at right angles—that is to say, when the tips of the antennæ point in the direction from which the sound comes. The male, therefore, must be able to estimate very exactly the whereabouts of the female.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

The Inventors' Show at New York

THE Exhibition of Inventions at the Grand Central Palace in New York, held December 12th to 19th, while quite modest in its proportions and far from spectacular in its setting, contained many points of interest to practical people, and this was the notable characteristic of the show, that it was essentially practical, for the majority of the inventors who exhibited their ideas had devoted their efforts to everyday affairs and needs. One of the most prominent lines of invention shown related to railroads, and several forms of metallic ties were shown, as well as an ingenious renewable rail head. Another apparently practical device that appealed to the visitors was a "portable trip," for stopping trains in case of accident. A number of roads are equipped with an apparatus by which the brakes of a train can be applied by the operator in a signal tower, and consists of a pendent lever on the train connected with the brake apparatus, which comes into contact with an arm that the signal operator can throw into contact position when necessary, thus enforcing the stopping of the train should the engineman fail to see an adverse signal; but this arrangement can now only be applied at the signal tower, and it occurred to Charles F. Peel, an experienced railroad man, to produce a portable trip that a flagman, sent back to protect a standing train, could take with him, and by placing it on the track make certain the stopping of a following train, even if his flag was not seen on account of fog or darkness. It would also be valuable in protecting workmen on the tracks. The device, which is shown in an illustration, is simple, and easily carried, and as that is secured in place only by a spring it is but the work of an instant to snap it onto a rail anywhere. It appears to provide against a class of accidents that have been painfully frequent.

Farmers are not usually supposed to be inventors, but George G. Bates has produced a new kind of hay wagon that he claims to have saved him a great deal of time and labor. When a mechanical loader is used two men are kept busy passing the hay forward from the delivery point at the rear, and frequently when unloading this work has to be repeated. In the new automatic rack a track with small rollers is located on the usual platform, and on this is mounted a light supplementary rack half the length of the main rack. When the loading commences this supplementary rack is placed at the rear end of the main rack, and the loader delivers the hay directly onto it, where one man easily treads and distributes it. When this short rack is full the operator pulls a cord which couples up a gearing connecting the supplementary rack with the rear wheels of the wagon, with the result that the loaded rack is run to the front end of the main rack without stopping the team, carrying with it the half load of hay that has been taken on; and the loader continues depositing hay on the now empty rear half of the main rack, thus completing the entire load with practically no hand work. When unloading, the same operation can often be taken advantage of with a considerable saving of labor and time.

Another handy farm device is the Davis portable fence. Almost any farmer who keeps cattle or small animals finds frequent occasion to limit them to some portion of a grazing ground, or to pen a portion of them for some purpose for a time; and in such cases it is customary to run up a temporary fence. Even when light in character this entails considerable work, and the portable fence in question meets the conditions effectively at a reasonable cost. It is built in sections that can be coupled together in any combination desired as fast as the panels can be handled, as each panel is a permanent structure complete in itself.

Few things are more irritating and offensive than an untidy street or road, and with the increasing interest in good roads more attention is being given to the care of the same. Anything that facilitates a piece of work tends to improve its quality, and with this idea the Gravelle street cleaner has been designed. It is in the form of a wide scraper on wheels for collecting rubbish, with a considerable capacity, so that large areas can be cleared up quickly and the rubbish carried to some convenient dumping point. The scraping edge can be raised or lowered as conditions demand; but a very practical feature is a rake of the full width of the machine which can be raised and moved forward and back as desired. By this means, as rubbish collects on the forward part of the scraper, the rake can be lifted and dropped in front of the collections, which are then drawn back onto the body of the machine for transportation. This scraper can be built in sizes suitable either for hand or horse power.

A new idea for family use is the Frisk no-cost hot-water heater and gas-burner, in which the burner for a gas stove is cast hollow, with a series of passages for circulating water through the body of the burner. By this arrangement, in connection with a tank conveniently placed, a constant supply of hot water is secured at the same time that cooking is being done, without consuming gas specially for this purpose, thus effecting quite an economy of fuel.



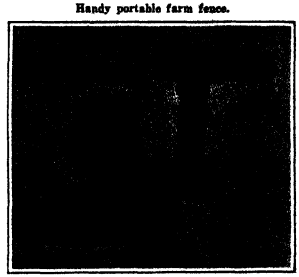
A new street scraper with collections drawn back.



Operating the rake of the street scraper.

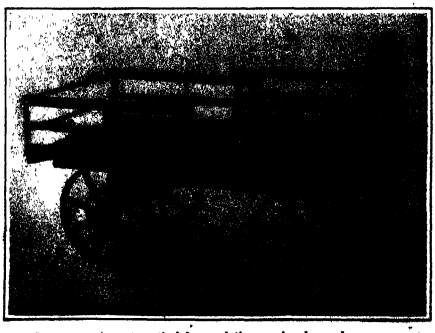


Handy portable farm fence.



Portable air-brake trip for preventing railway accidents.

Standing of United States Seaports.—Our total foreign trade for 1913, including imports and exports, was four and one quarter billion dollars, and of this amount about two billion dollars was handled through the port of New York. The second seaport is Galveston, which handled $290,000,000 worth of goods. Then follow New Orleans, $252,000,000; Boston, $216,000,000; Philadelphia, $170,000,000; Baltimore, $150,000,000; San Francisco, $130,000,000; Puget Sound ports, $114,000,000; Buffalo, $81,000,000, and Detroit, $71,000,000.



An automatic labor and time saving hayrack.



Burner for cooking and heating water simultaneously.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the Scientific American.

Pertaining to Apparel.

CLASP.—NORMA F. SCHAFER, 47 Brevoort Place, Brooklyn, N. Y., N. Y. In the present invention the object is the provision of a new and improved clasp, more especially designed for use on hose supporters and like devices, and arranged to securely grip hose or other fabric material without danger of tearing it.

Pertaining to Aviation.

FLYING MACHINE.—J. E. POLIERI, 1510 N. Roguedo St., New Orleans, La. The more particular purpose in this case is to improve the stabilizing of the machine while in the air and to facilitate the guiding of the machine up or down. The inventor seeks to promote the safety of the machine in ascending either at the will of the operator or in case of accident.

Electrical Devices.

MOLDING OR CONDUIT FOR ELECTRIC WIRES.—F. ADSON, 10 Cooper Square, New York, N. Y. The invention relates to moldings or conduits for systems of interior and exterior wiring, and more particularly to conduits of that type, consisting of a trough or base section for receiving the wires and a cover section having side flanges that spring or snap over the sides of the trough section.

CIRCUIT INTERRUPTER FOR THERAPEUTICAL APPARATUS.—F. M. KIDDER and M. H. KIDDER, 820 Broadway, New York, N. Y. The invention has for an object the provision of means for regulating the strength of the treating current by adjusting the armature of the interrupter, these being used in connection with the adjusting means a device whereby it is impossible to adjust the armature beyond its vibratory limit, or too close to the pole of the interrupter.

INDUCTION COIL CASING.—H. D. GRISWELL, Agricultural National Bank Building, Pittsfield, Mass. The invention provides a casing which will protect the coils completely from rain or snow. It also provides a casing which is provided with a cover which holds the coil in position without the necessity of locking means, and which can be removed or replaced in a minimum time.

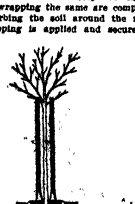
Of Interest to Farmers.

SHOCK BINDER.—P. H. CASEY, care of M. J. Casey, New Richmond, Wis. The object here is to provide a simple and inexpensive device whereby a shock of grain can be quickly and easily tied or untied; and when the shock is tied by means of the device the device cannot loosen itself accidentally, that is, when the shock is handled as is customary.

PEA THRESHER AND HARVESTER.—G. E. PRITCHARD, Lilly, N. C. The machine is adapted to be drawn over the field and provided with suitable guide elements to direct the vines of a row properly to the machine, there being a beater turning transversely, or approximately so, to the direction of travel to strip and thresh the peas, an arrangement of raking elements and forks so disposed and driven as to cause the threshed peas to be delivered rearwardly into a suitable receiving chamber at the rear of the vehicle.

Of General Interest.

TREE BALLING DEVICE.—C. I. HELM, R. F. D., No. 1, Phoenix, Ariz. An object of this invention is to perform with facility the work of digging and balling without disturbing the roots or soil. The three steps of digging the tree and wrapping the same are completed without disturbing the soil around the roots, and the wrapping is applied and secured in

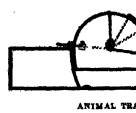


TREE BALLING DEVICE.

a manner to maintain the ball intact, until received by the purchaser. The invention is exceedingly useful in moving small trees as the stems do not have to be cut, which is now usually done, and the loss of which by transplanting or balling is very great. [illegible] Sydney, Australia, recently [illegible] the invention. An expert here is to [illegible] which may be applied to a can[illegible]

claimed will having lime or other alkali, and which will not crack or scale off from the effects of such lime or alkali, but which will have a smooth and uncracked surface.

ANIMAL TRAP.—C. PHILLIPS, Bland, Mo. The invention has reference more particularly to a device comprising a balanced bait compartment adapted to communicate with the bait compartment when an animal enters the



ANIMAL TRAP.

said bait compartment, and whereby the animal in the bait compartment can escape only into the cage compartment. This simple and inexpensive trap is automatic in its action.

BRUSH.—H. C. BROWN, 503 St. John's Place, Brooklyn, New York, N. Y. This invention relates to brushing and scrubbing, and has particular reference to the construction of brush heads whereby such devices are rendered more convenient and serviceable than those commonly employed.

COMPOSITION OF MATTER FOR CLEANING.—E. C. BILTON, 612 W. 115th St, New York, N. Y. The composition of matter is in the form of a thick paint, and consists of an aggregate and a cleansing agent to keep the composition normally in the form of a thick paint, for applying the composition as a coating to the article to be cleaned, to embed the extraneous matter, the coating after drying being capable of cracking and pealing off from the article.

BILGE PUMP.—T. S. BULMER, Greenport, Suffolk Co., N. Y. The purpose here is to provide a simple, inexpensive structure particularly adapted for use upon small boats and embodying a minimum number of readily accessible parts whereby it may be maintained in good working order, easily and at all times.

ARTIFICIAL LIMB.—A. E. TULLIS, Fargo, N. D. The main object in this invention is to provide an air-inflated socket at the stump opening, which is continuous entirely around the said stump, which is readily removable from the limb for repair, substitution, or other reasons.

BOX.—MORRIS J. WHEELER, Box 52, Petersburg, N. H. The body of the box is formed of a single strip formed into a flat coil, with the convolutions one within the other, and in which the inner convolution will have increased height, thereby presenting a neck within the outer convolution to receive the flange of the cover, the exterior of the outer layer and of the flange of the cover being flush, or forming parts of the same cylindrical surface.

VIBRATOR.—L. L. MONTGOMERY, 2509 Oak St., Superior, Wis. The invention refers to vibrators used for massage purposes, and has reference more particularly to vibrators actuated by elastic fluid. The object of the invention is attained by providing a plunger adapted to be actuated particularly by elastic fluid operable means, with means for returning the plunger to its normal position.

Hardware and Tools.

WRENCH.—I. S. OVERHOLSER, Oakes, S. D. This invention relates to wrenches, and more particularly to that type known as pipe wrenches, and one of the principal objects is to provide a pipe wrench, which may be securely locked on pipes of various sizes by one movement and without the necessity of preadjustment.

DEEP WELL DRILLING TOOL.—C. A. BUTLER, Okmulgee, Okla. Among the objects of the inventor is to so equip a rock drill as to provide for a proper circulation of the fluids surrounding the drill bit so as to prevent the gumming up and sluggish operation of such tool while operating through soft or sticky material.

Heating and Lighting.

HEATING SYSTEM.—F. H. NEUBERGER, Jeffersonville, N. Y. The purpose in this instance is to provide an improved structure in which the smoke and heated gas from the stove or furnace may be utilized for heating purposes through the use of conducting pipes and radiating surfaces over which the smoke and heated gases are adapted to pass.

BRIQUET.—J. ALEXANDER, II Ottensener, Merkplatz, Altona, Germany. According to the present invention a high-value briquet is produced of a calorific value of about 6,900 heat units, which, as careful tests have shown, can already be produced at a pressure of 100 at atmospheres, and which, when burnt on an ordinary grate, will retain its coherence like ordinary mineral coal.

Household Utilities.

KITCHEN UTENSIL.—T. A. BURRS, 308 S. Pearl St., Galesburg, Ill. This invention relates more particularly to an implement adapted for use either as an egg separator, egg beater or cream whipper, the object being to provide a combined utensil of this character which is simple and inexpensive in its structure and highly effective in use.

STOVE LID.—N. E. RICE, Garberville, Cal. This invention has for one of its principal objects the provision of a stove lid by means of which a cooking vessel may be supported out of direct contact with the stove top, and thus scorching or burning of the contents of the vessel may be prevented.

FLY KILLER.—L. W. KARSCHNER, Pikes Creek, Pa. In this invention the device is so constructed and arranged as to be employed either as a swatter or as a trap, means being provided for readily converting the device to adapt it for either use. When arranged as a trap, sticky fly paper is employed in connection with the device.

BEDSTEAD CORNER FASTENER.—W. C. MURRAY, Corry, Pa. The general objects of the invention are to improve and simplify the construction and operation of bedstead joints so as to be reliable and efficient in use, comparatively inexpensive to manufacture, and so designed as to provide a strong and substantial connection between the side bars and corner posts.

PEA SHELLER.—E. MADELINE STEWART care of J. B. and S. W. Brooks, Boston, Ga. The pea sheller is especially distinguished by an improvement in form number, and coaction of pairs of rollers between which green pea-pods are passed for feeding them to a knife by which they are slit neatly and expeditiously

Machines and Mechanical Devices

UNDERREAMER.—T. S. ADCAR, 6 East 8th. Robinson, Ill. This tool is especially adapted for underreaming well casings, as, for instance, in gas, oil or other wells, wherein the reaming mechanism may be contracted within a diameter less than that of the interior of the well casing to permit the passage of the tool through the casing, and wherein means is provided for automatically expanding the reaming mechanism when the proper position is reached, and wherein the parts may be again contracted to permit the removal of the tool from the casing.

CLUTCH.—E. H. BUCKLEY, Caledonia, Minn. The invention comprehends a clutch providing a revolving drum and with a cable to be wound by the rotation of said drum, a sweep normally connected with the drum for turning the same, and disconnecting mechanism controllable at a distance, and of special construction for rendering certain and positive the disconnection of the sweep

MECHANICAL MOVEMENT.—S. MERTEL, 92 Catharine St., New York, N. Y. This invention relates to hand operated devices, such as egg beaters, fans and the like. Among the objects is to simplify and improve this class of hand motors whereby they are cheapened in construction and rendered more effective than devices heretofore proposed for the same purpose.

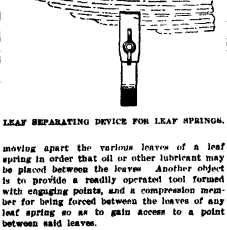
EJECTOR.—J. R. BARKER, 2007 Swift St., Jacksonville, Fla. The invention relates to dredging or excavating machinery and has particular reference to certain specific improvements in hydraulic dredges or dredges which depend for their operation upon the injector action of a current of water, air, steam or the like under pressure and discharged through a contracted opening

Pertaining to Recreation.

SWIMMING DEVICE.—E. G. OSTERBERG, 180 Vernon St. Worcester, Mass. This invention provides a device for use on a person's foot to facilitate swimming, to enable the swimmer to make better speed, and to more effectively sustain the swimmer, especially when playing water polo or other aquatic games

Pertaining to Vehicles.

LEAF SEPARATING DEVICE FOR LEAF SPRINGS.—R. I. EMERSON, Montgomery, N. Y. The object of the invention is the provision of an improved structure for spreading or



LEAF SEPARATING DEVICE FOR LEAF SPRINGS.

moving apart the various leaves of a leaf spring in order that oil or other lubricant may be placed between the leaves. Another object is to provide a readily operated tool formed with engaging points, and a compression member for being forced between the leaves of any leaf spring so as to gain access to a point between said leaves.

AUTOMOBILE TIRE TOOL.—W. J. SMITH, care of J. Arthur Jackson, Gananoque, Ontario, Canada. In this device the lever has its front end in the form of a rigid, forwardly extending hook presenting an open side to receive the wheel rim and tire rim, and in connection with the said lever a tire-pressing device is provided to compress the tire transversely, the tool being rockable, as usual in tools of this character, in a plane transverse to the rims and tire

COLLAPSIBLE GO-CART.—C. A. PIPPIN, Weldon, Ill. The object of the invention is to provide a simple, strong, and inexpensive collapsible go cart, which when collapsed will be in the shape of a receptacle, inclosing all the parts of a go cart, which receptacle will be convenient to carry and attractive in appearance

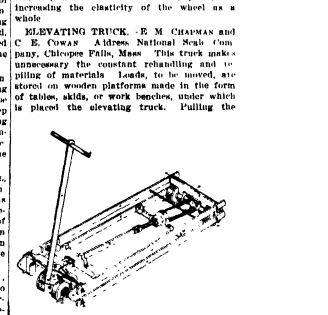
DIFFERENTIAL DRIVING MECHANISM.—A. J. CARLSON, Fellows, Cal. This improvement has reference to transmission devices for automobiles and the like, and has particular reference to a novel means serving the purpose of the usual differential gear mechanism associated usually with the driving axle of a vehicle.

AUTOMOBILE NUMBER DISPLAY DEVICE.—G. B. MUELLER, 18th St and 7th Ave Whitestone L. I. N. Y. In this invention the improvement has reference to license numbers for automobiles and other vehicles, and relates more particularly to an illuminated device of such design that it can be readily seen by day as well as by night

REVOLVING DUMP CART.—E. G. LEDYARD, Sioux Falls, S. D. It is the design in the present patent to provide a dump cart especially adapted for use in grading, road work and the like, and in which the body or pan is mounted to revolve on a horizontal axis for dumping the load

SPRING WHEEL.—S. BROWN care of Sam mons Brown & Sons, Ltd 40 Whitcross St London, England. This invention relates to improvements in that type of resilient vehicle wheels in which resilient spokes are employed, and the aim is to simplify the construction of such wheels by reducing the number of parts lessening the friction of the moving parts, and increasing the elasticity of the wheel as a whole

ELEVATING TRUCK.—E. M. CHAPMAN and C. E. COWAN, Address National Scale Company, Chicopee Falls, Mass. This truck makes unnecessary the constant rehandling and repiling of materials. Loads, to be moved, are stored on wooden platforms made in the form of tables, skids, or work benches, under which is placed the elevating truck. Pulling the



ELEVATING TRUCK WITH HYDRAULIC CHECK.

handle downward raises the loaded platform from the floor. After conveying it to the desired location, pressing a handle release mechanism which operates the hydraulic check, allowing the load to slowly descend to the floor without shock or jar or danger to the operator from a flying handle. The truck is then in readiness for the next load.

Designs.

DESIGN FOR A SWIVEL FOR EXERCISERS.—D. G. DANIELS, 232 E. 42nd St., New York, N. Y. In this design for a swivel for exercisers one view shows a side elevation of a swivel and the other an end elevation thereof, both views showing the new design

DESIGN FOR A PENCIL GUARD AND CLIP WITH ATTACHED RUBBER.—F. ECKERMANN, care of Rio Grand Valley Bank and Trust Co., El Paso, Tex. In this ornamental design, the pencil guard, clip, and rubber are shown in three positions, rear elevation, front elevation, and side elevation

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War Experiences of an Air Scout

(Concluded from page 880.)

enough beds for one half of the recruits, I would be obliged to sleep upon the floor like the rest. He informed me, through my fellow aviator, Fitzux, that owing to the great number of wounded soldiers arriving at Havre he was obliged to send nearly half of the beds to the neighboring hospitals and private residences to accommodate the wounded. I decided to remain at one of the hotels and await his reply.

The next morning I returned to the recruiting bureau for my reply, but there was none and I must come again in the evening, though the commandant informed me that it might take many days. I still saw many of those reservists who had come over with me waiting for an interview, they had waited throughout the entire day before in a very disorderly line, and, there being but one officer to see them, were obliged to retire at nightfall and return again at daybreak.

Four days later the answer from the Minister of War arrived, and I was ordered to report to the second aviation reserve at Tours, where I would have to pass the French examination for pilot. This was a simple test, as the requirement was that I take an aeroplane up 7,000 feet and remain at or above that altitude for an hour at least.

During the four-day stay at Havre I had an opportunity to see something of the town. Nearly all factories were closed, and the sight of women, both young and old, sweeping the streets clean and collecting the fares on the tramways was rather peculiar. I also had the opportunity of inspecting in detail two of the armored trains, equipped with heavy guns, which fired a shell about 6 inches in diameter, almost at any angle, even at the speedy aeroplane. The gun was loaded from the ammunition car, in which was located an observation tower, which permitted the observer to get the range of the enemy and direct the firing from a height of 30 feet. Four jacks held the train to the tracks while firing was in progress. They were to have left for the front in a couple of days.

Barricades of Paris.

I left Havre for Tours on September 18th. I had to go to Paris first and then change for Tours. It took 11 hours to travel from Havre to Paris, and I was obliged to sit up the entire night. I had time in Paris to see many of the preparations made to receive the Germans, in case the city had to stand a siege. All of the stores that were closed had their fronts boarded. At the point where Avenue de la Grande Armee terminates in the wall surrounding Paris a temporary barricade had been hastily erected of 3-inch by 12-inch by 16-foot spruce planks running from the wall close to the tramway tracks. Holes had been provided in the planks every three feet from which to operate machine guns. Directly in front of this barricade a ditch had been dug similar to that which surrounds the wall about Paris, and, in front of the ditch upon the once beautiful boulevard, opposite which the "Luna Park" is located, huge trees and branches had been strewn. In the Bois de Boulogne, a park just beyond the wall, thousands of head of cattle were grazing peacefully. The Eiffel Tower was surrounded by a strong wooden fence and guarded day and night by soldiers. The only factories operating were those that were turning out supplies for the government; the remainder were closed through lack of men. The streets were filled with people, and the restaurants and wine shops did a thriving business. After 6 o'clock, however, they were closed.

A Train Load of Wounded Soldiers.

I managed to get a train for Tours the night of the 19th. It was crowded with wounded soldiers, many of whom had to stand because of the lack of seats. I gave up my seat to a wounded man. He had been shot in the hip, and the bullet was still in the wound. He had also been struck by a clubbed gun in the hands of an enemy, and his head was in bad shape. His suffering was intense, but the man

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Inquiry No. 9403. Wanted the name and address of a glass manufacturer who can blow a small glass article to order.

Inquiry No. 9404. Wanted the name and address of a manufacturer of a tool for cutting nicks in plate glass used for name plates and house numbers.

Inquiry No. 9405. Wanted the name and address of a manufacturer who is able to supply an electrically operated, aluminum or celluloid through which a snap fastener would work.

Inquiry No. 9406. Wanted the name and address of a manufacturer who can supply insole material in rolls. The material seems to be scrap leather composed and attached to a canvas bottom.

Inquiry No. 9407. Wanted the name and address of some patented mechanical device which saves money or time or both, which if properly handled will bring a large demand. It need not be too expensive. It may be electrical as well as mechanical. A first class article desired.

Inquiry No. 9408. Wanted the name and address of a manufacturer or distributor of a machine which will clean both single and double burlap bags; especially heavy bags.

Inquiry No. 9409. Wanted to secure a patented device which can be manufactured at small cost and Standard products easy to make. Box 530, Atlanta, Ga.

Inquiry No. 9410. Wanted the name and address of manufacturers of "leather shoes."

Inquiry No. 9411. Wanted the name and address of a gas lighter using some form of platinum block which ignites by holding over a few of gas.

Inquiry No. 9412. Wanted the name and address of a manufacturer that makes machinery for making linkcrome ribbons for typewriters.

Inquiry No. 9413. Wanted the name and address of a manufacturer of automobile rigs for polishers or users. Miniature pad users of same as large upholster pads. Celluloid protecting shield.

Inquiry No. 9414. Wanted the name and address of a manufacturer who will make an armchair with an adjustable foot rest.

[illegible] Aviators

[illegible] Some of my fellow pilots were quite prominent in the flying game. Others of them were very wealthy. It seemed odd to me to think that we should all be eating at the same table and sleeping in the same room, receiving no more consideration than was given the average French soldier. Among the pilots present were Jules Vedrines, the speed king, who won the Gordon Bennett race at Chicago two years ago; Count de Lambert, the oldest aviator in France and who was the first to learn from the Wright brothers (he was now taking instructions on the Voisan biplane); Fournier, the holder of the French endurance record of 13 hours for many years; Simon (the fool flyer), well known in the United States; Jensen, from Denmark, who months ago flew from France completely across Germany without alighting to land in Russia, one of the longest non-stop cross-country flights on record; and many others too numerous to mention. Messrs. Vedrines, Count de Lambert, and Fournier were holders of the legion of honor medal, and wore it prominently displayed on their breasts. There were also many pilots of foreign birth present, among them three Russians, several Englishmen, two Belgians, two Italians, and one Spaniard, but, apparently, I was the only American enrolled.

That night some of the pilots had a pillow fight in the Palace Hotel; but I was too tired to mind it. Later on, however, the pillow fights became a regular affair every evening, and sometimes in the morning, and proved to be very amusing, especially when considering that the pillow fights were the nearest to a real battle that some of them would ever get.

(To be continued.)

Air Transparency for Infra-red Rays

(Concluded from page 522.)

[illegible] filtered out of it for photographic purposes, only such objects as would stand at less than 33 feet from the objective would appear on the photograph, as a layer of air but 10 meters thick is completely opaque to such radiations. In the neighborhood of 1,063 A. U. even a layer of air one meter thick will stop such ultra-violet light.

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[illegible] Ammonia [illegible] ..... 0.04 gramme
Silver nitrate solution at 10% ..... 5 drops

All of these chemicals are placed into separate vials. When it is desired to sensitize the plate the ammonia and the alizarin blue are introduced into the alcohol; the flask is stoppered and agitated for about 5 minutes, to favor the dissolution of the dye. The solution is then filtered into a flask which contains the five drops of the silver nitrate solution. The liquid is moved again and poured over the plate into a 5 by 7-inch dish, which is rocked while the bath acts during exactly 3 minutes. The plate is then washed for 3 minutes in running water. After the back has been wiped dry with blotting paper it is laid vertically in a light-proof box, the bottom of which is covered with a layer of blotting paper, and which contains a dish full of fused calcium chloride. About one hour later it may be placed into the plate holder.

From the filtration of the bath until the placing of the plate into the plate holder, every operation must be done in complete darkness or with the help of a very faint green light of the proper kind, i. e., made expressly for plates sensitive to the red and beginning of the infra-red.

Strategic Moves of the War

(Concluded from page 522.)

[illegible] been completely destroyed in the campaign back and forth across this district. The advantage in this respect now lies very appreciably with the Russians. Their base at Warsaw lies close to an important part of the battle line, while their troops farther to the south have the advantage of operating in home territory.

Now that the first rush of the German army is checked, the outcome of the fighting in this central portion of the battle line depends quite largely on which side can most rapidly move to the front reinforcements of men and guns. In this the Russians should have a decided advantage. The fighting in this district bids fair now to develop into a deadlock similar to that in France.

In case the combatant forces in Poland succeed in entrenching themselves so strongly as to bring the campaign there to a deadlock, the immense numbers of the Russian army will give them the advantage in the next move of the campaign. This will consist in extending the lines northward as fast as troops can be moved to the front, just as occurred in France during September and October. The district between the Vistula and the East Prussian border will first acquire added importance. If the decision is not reached here the active fighting will again return to East Prussia for the determination of the great battle in northern Poland.

The operations in East Prussia during the week have been of minor importance. The Russians claim now to have advanced to Lotzen, on the eastern edge of the lake region. The battle line in this district now starts southwest of Johannisburg and runs through Arys, Lotzen, Darkehmen, Gumbinnen, and Pillkallen. Both of the contending nations seem to have slackened operations in this district while waiting for the outcome of the great battle in Poland.

Considering this campaign as a whole, the result of the week's fighting has been as an even exchange. The Russians have defeated the German effort to advance southward from East Prussia toward Warsaw and have driven this force back to a position near the German border. In the south the Austrians have succeeded in the first stage of their campaign against the Russians' left flank and have forced the Russians to retreat from their position southeast of Cracow.

The Campaign in Turkey.

At the mouth of the Euphrates River the British Indian force has taken possession of the river for one hundred miles from its mouth. The capture of Kurna, where the Tigris joins the Euphrates, gives them an important strategic point for the control of this region. There is little to be gained by a further advance unless the Turkish resistance should prove



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Beginning This Week

War Experiences of An Air Scout in France

By Frederick C. Hild

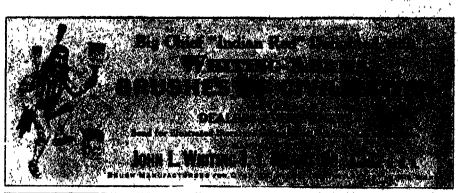
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Read the first installment
Page 520 of this number





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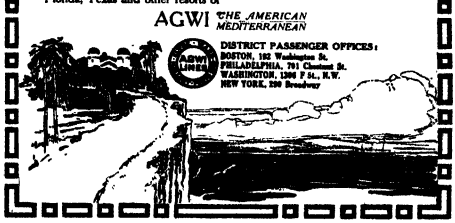
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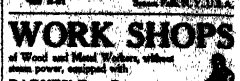
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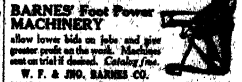
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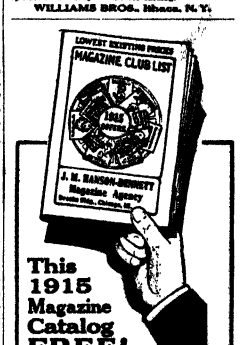
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Hindu Jugglery

(*Concluded from page 516.*)

is called at the end of the trick, as above. Of course the basket has a double side at the back, not a double bottom, and when showing the open basket before the trick, the false side is slipped back to show the full width. Merely as a wrong scent, the juggler turns over the basket with its face to the ground and beats it on the back with his sword, as if that were the convincing way of showing it to be empty. Thus, when the second girl is in the basket and she has crept into the false compartment, which she has placed in position, the juggler shows the open basket and very quickly turns it on its face and beats it on the back as before, merely to convince the spectators by the association of ideas that the basket is empty and thus to prevent them from noticing the diminished width due to the false compartment.

The juggler is careful to thrust in the sword at several places on the longitudinal line of the middle of the basket, so as to avoid the false compartment; and as the sword is obviously thrust down as far as it will go, the spectators are duly deceived, and the second girl still remains in the hidden compartment till the spectators are examining the first girl miraculously come back to life, and the basket and cloak are removed by the assistants. Then, during the next feat, which follows in quick succession, she emerges at the back of the assistants, puts on the cloak, and slips away. The blood is only liquid pigment.

so weak that a small force can overrun southern Mesopotamia.

The arrival on the Isthmus of Suez of the contingent from Australia and New Zealand will greatly strengthen the British defense of the canal. No operations in this district have been reported since the repulse of the Arab raiding party that penetrated within eighteen miles of the canal.

The campaign along the Caucasian border is still going against the Russians. The Turks now control the strip of territory south of Batum lying between the Chorok River and the border. Farther to the east the Russians have crossed the border and have entered the headwaters of the Euphrates River.

The Servian Campaign.

The farthest advance of the Austrians into Servia reached the line joining Belgrade with Uzice, eighty miles to the southwest. On December 9th the Servians delivered their counter blow by attacking the left wing of the Austrian army south of Belgrade. The Austrian resistance was overcome and their army was forced to fall back to a new line running from Rogacica, near the Bosnian border, northeast along the Kolubera River to Belgrade.

The influence of the Russian campaign is shown in the success of the Servians. The Austrian advance was made by an army of seven corps. When Belgrade was captured and the Russians were invading Hungary through the Carpathian Mountains the pressure was so great that three corps were taken from Servia to make the flank move against the Russians via Dukla and Jaslo.

The Servians discovered this reduction in the strength of the army of invasion under Gen. Potiorek and launched their attack south of Belgrade. When this flank gave way they transferred their attack to the center and broke down the Austrian resistance. The Austrian right flank made a hasty retreat across the Drina River, where they were caught in flank by the Montenegrins at Vishegrad in Bosnia. The Austrian center fell back with large losses to a position between Loznica and Sabac in the northwest corner of Servia. Their left wing abandoned Belgrade to the Servians and crossed the Save River to Austrian territory. This great victory of the Servians has at one blow cleared their territory of the invading army except for the small corner between the Drina and the Save rivers.

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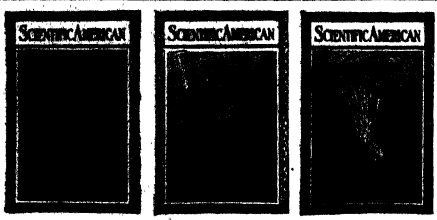
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FOR a complete history of the automobile refer to the files of the Scientific American. The whole story is there from the birth of the motor-driven vehicle, long before the first automobile journal was published, down to the present day. Week by week the biography is written and annually there is a **resumé** of the year's developments. The seventeenth annual **resumé** will be found in the issue of January 2, 1915. The following are some of the subjects that will be taken up:

The Car of 1915. One might suppose that in all these years of development the automobile had reached a point where there would be practically no further growth. However, the new year ushers in some important innovations and a great many lesser improvements, which, slight as they may seem, make for greater comfort and convenience. They will be described fully and illustrated with sketches.

Military Tactics and the Motor. The absolute necessity of the motor car in modern warfare has been demonstrated in the present titanic struggle in Europe. A very comprehensive article has been prepared on the use of the motor vehicle in transporting guns, ammunition, supplies, and men, and in bearing the wounded to the rear.

How Small Communities May Have Good Roads. Never in the world's history have roads been subjected to such hard usage as in the present day, and never has the subject of road-building received so much scientific investigation. Yet out of two and a quarter million miles of public roads in this country, only a quarter of a million are improved with any form of surfacing. Evidently there is still a great deal of work to be done by rural communities. Logan Waller Page, Director of the Office of Public Roads, gives some valuable suggestions on co-operative undertakings that will make good roads available for small communities.

American Auto Coach Work. Foreign car-body builders, instead of following standard patterns, have shown a great deal of originality in the design of car bodies This is now having its effect on our own car-body builders, who are coming out this year with many artistically modeled vehicle bodies There will be a discussion of this subject with pointed criticisms of various models, both foreign and American. The article will be illustrated with a score of automobile body designs.

The Fuel Problem. The enormous demands upon our supplies of hydrocarbon fuels have made it necessary to develop new methods of obtaining fuels volatile enough to be used in the motor car. The Burton process of producing gasoline has done much to relieve the shortage. Just what this process is will be explained in full.

Purchaser's Guide. As in previous issues of the Annual Motor Number there will be a table of American-made cars classified according to price, so that the prospective purchaser may know what he can buy for $500, $1,000, $1,500, etc. There will be a similar list of commercial vehicles classified according to capacity.

In addition to these and other articles there will be illustrations and brief descriptions of the latest automobile accessories. There will be an oiling chart for the automobile, explaining what parts need attention in the standard chassis and engine. A motorcycle trouble chart will explain where troubles are liable to occur and how they may be overcome or avoided.

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